Agilent X-Series Signal Analyzer

This manual provides documentation for the following X-Series Analyzers:
PXA Signal Analyzer N9030A
MXA Signal Analyzer N9020A
EXA Signal Analyzer N9010A
CXA Signal Analyzer N9000A

89601X VXA Measurement Application User's and Programmer's Reference

Option 205 Basic VSA-lite
Option 333 Connectivity to X-Series Analyzers
Option AYA Vector Modulation Analysis
Option B7R WLAN Modululation Analysis

Agilent Technologies

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Documentation is updated periodically. For the latest information about this analyzer, including firmware upgrades, application information, and product information, see the following URLs:

http://www.agilent.com/find/pxa
http://www.agilent.com/find/mxa
http://www.agilent.com/find/exa
http://www.agilent.com/find/cxa

To receive the latest updates by email, subscribe to Agilent Email Updates:

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http://www.agilent.com/find/tips

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Contents

Contents

Contents

List of Commands

List of Commands

List of Commands

List of Commands

List of Commands

List of Commands

1 Using Help

Welcome to the X-Series Signal Analyzer Help system!

The online Help system is "context-sensitive". This means that the information displayed when you invoke the Help system depends on the selected Analyzer Mode, Measurement and key.

TIP	To view help for any front-panel key or menu key, press that key with this Help Window open. To scroll any page vertically (to see the whole of a long topic), press the **Down Arrow** key on the front panel to scroll down (or the **Up Arrow** key to scroll up). To locate these keys, see “Front Panel Keys used by the Help System” on page 71.

See “Navigating the Help Window Without a Mouse” on page 76 for complete information about **Using Help without an attached Mouse and Keyboard**. For specific details of how to navigate to topics, see “Finding a Topic without a Mouse and Keyboard” on page 85.

See “Navigating the Help Window with a Mouse” on page 74 to learn about **Using Help with an attached Mouse and Keyboard**.

You can view Help on the Analyzer itself, or you can **View Help on Another Computer**, by copying the Help files and viewing Help there. For details, see the Section “Viewing Help on a separate Computer” on page 65.

To locate **Other Available Help Resources**, see “Locating Other Help Resources” on page 64.

Key Path	**Help**

Locating Other Help Resources

All available documentation is present on the Analyzer’s hard disk, either as HTML Help or Acrobat PDF files.

In addition to the interactive Windows (HTML) Help system, the Analyzer’s hard disk contains Application Notes, tutorial documents, etc.

This same documentation is also included on the Documentation CD shipped with your Analyzer.

Many of the supporting documents use the Adobe Acrobat (PDF) file format. You can view PDF files using the pre-installed Adobe Reader software.

The Adobe Reader user interface differs from the Windows Help interface. For full details on how to navigate within Acrobat documents using Adobe Reader, see “Navigating Acrobat (PDF) Files” on page 80.

Viewing Help on a separate Computer

You may want to view the help pages **without** having them appear on top of the Analyzer's screen.

There are two separate Help files for each Analyzer Mode, which contain all the same help pages in different formats:

1. A file in HTML Help (CHM) format,
2. A file in Acrobat (PDF) format.

You can copy any of the Help files to another computer, then open and view the help pages in the file on that computer.

Your choice of which file to copy and view may depend on what you want to do with the file (for example, whether you want to print it and read the paper copy, or view it on the computer). The table below compares the relative advantages of the two formats:

Format Type	**HTML Help** Format (**CHM** Files)	**Acrobat** Format (**PDF** Files)
File Extension	CHM	PDF
Software Required to view file	Microsoft Windows operating system only, with Microsoft Internet Explorer installed.	Free Adobe Reader software can be downloaded for many operating systems, including: Microsoft Windows, Macintosh, Linux, Solaris.
Full Text Search?	Yes	Yes
Printable?	Yes, but with limited control.	Yes. Full print control.
Printable Table of Contents?	No	Yes
Navigable without a Mouse and Keyboard?	Yes, but with some loss of functionality.	No
Has Page Numbers?	No	Yes
Context-Sensitive Display?	Yes, when viewed using the X-Series Analyzer application window.	No
Indexed?	Yes	No
Active Hyperlinks?	Yes	Yes

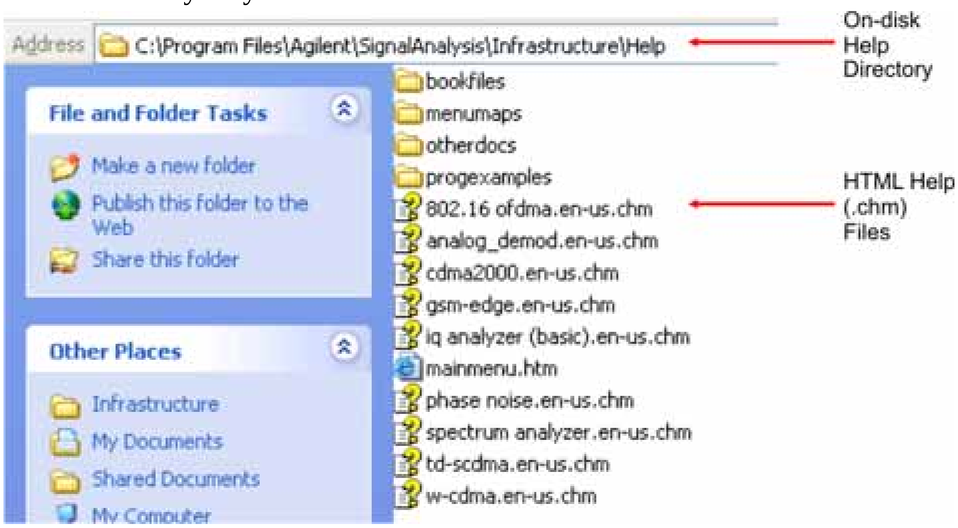
Copying the HTML Help (CHM) Files

You can copy the HTML Help file(s) you need to a separate computer running Microsoft Windows. Each HTML Help file has a `.chm` extension.

You can find the HTML Help (`.chm`) files:

- **Either**, on the documentation CD that came with the Analyzer,

- **Or**, in a special directory on the Analyzer's hard disk. The directory path is:
  `C:\Program Files\Agilent\SignalAnalysis\Infrastructure\Help`
  The illustration below shows an example listing of the HTML Help files in this directory, viewed using Windows Explorer.
  Depending on which Analyzer software licenses you purchased, the content of the directory on your machine may vary.



NOTE	You can open and view the HTML Help files only on a PC that has Microsoft Windows and Microsoft Internet Explorer installed.

Copying the Acrobat (PDF) Files

You can copy the Acrobat file(s) you need to a separate computer running any of several different operating systems. Each Acrobat file has a `.pdf` extension.

You can find the Acrobat (`.pdf`) files:

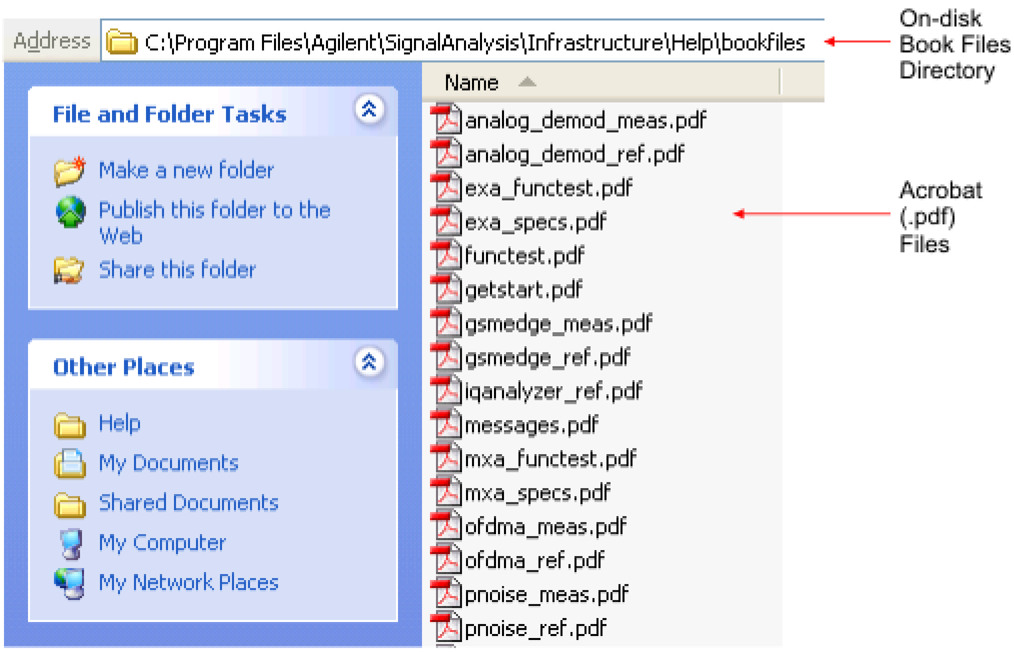
- **Either**, on the documentation CD that came with the Analyzer,
- **Or**, in a special directory on the Analyzer's hard disk. The directory path is:
  `C:\Program Files\Agilent\SignalAnalysis\Infrastructure\Help\bookfiles`

  — The illustration below shows an example listing of the Acrobat files in this directory, viewed using Windows Explorer.

  — The PDF versions of the help files are named `<mode>_ref.pdf`, where <mode> is the name of the Analyzer Mode. For example, the name of the PDF file for GSM/EDGE Mode is `gsmedge_ref.pdf`. (Note that the directory also contains other PDF documents.)

  — When you open any `<mode>_ref.pdf` document, the title page displays "`<Mode> User's and Programmer's Reference`", where <Mode> is the name of the Analyzer Mode described by the document.

  — Depending on which Analyzer software licenses you purchased, the content of the directory on your machine may vary.


Address
C:\Program Files\Agilent\SignalAnalysis\Infrastructure\Help\bookfiles
On-disk
Book Files
Directory
File and Folder Tasks
Make a new folder
Publish this folder to the Web
Share this folder
Other Places
Help
My Documents
Shared Documents
My Computer
My Network Places
Name
analog_demod_meas.pdf
analog_demod_ref.pdf
exa_functest.pdf
exa_specs.pdf
functest.pdf
getstart.pdf
gsmedge_meas.pdf
gsmedge_ref.pdf
iqanalyzer_ref.pdf
messages.pdf
mxa_functest.pdf
mxa_specs.pdf
ofdma_meas.pdf
ofdma_ref.pdf
pnoise_meas.pdf
pnoise_ref.pdf
Acrobat
(.pdf)
Files

How Help is Organized

This topic contains the following sections:

“Help Contents Listing” on page 68

“System Functions” on page 68

“Key Descriptions for Each Measurement” on page 69

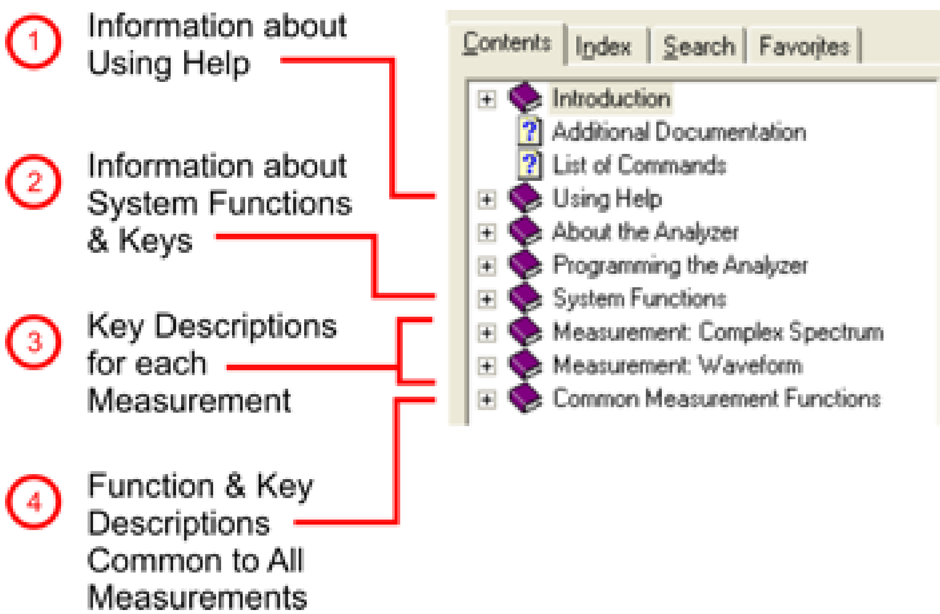
“Key Information for Softkeys” on page 69

“Common Measurement Functions” on page 70

Help Contents Listing

The listing under the Contents tab in the Help Window includes a topic for each Front-panel key and each softkey, for each available measurement.

The Contents listing is split into several major sections, as shown below for the HTML Help version of the document. The structure of the PDF version is similar.



Help information is split between these sections as follows:

1. Using Help: this section.
2. System Functions. See “System Functions” on page 68 below.
3. Measurement Functions. See “Key Descriptions for Each Measurement” on page 69 below.
4. Common Measurement Functions. See “Common Measurement Functions” on page 70 below.

System Functions

This section contains information for the following keys, which are listed in alphabetical order: **File**,

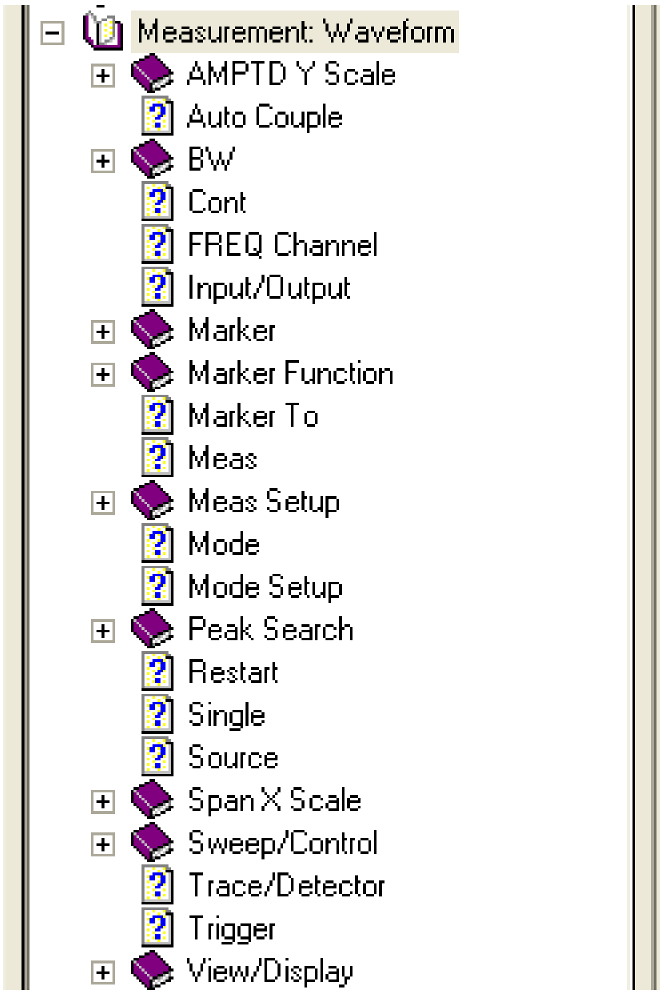
Preset, **Print**, **Quick Save**, **Recall**, **Save**, **System**, **User Preset**.

The functions of these keys do not vary between measurements: they operate the same way, irrespective of which Analyzer measurement you have selected.

The sections for **Recall** and **Save** contain only cross-references to the respective sections in "Common Measurement Functions" on page 70, and are included here for convenience.

Key Descriptions for Each Measurement

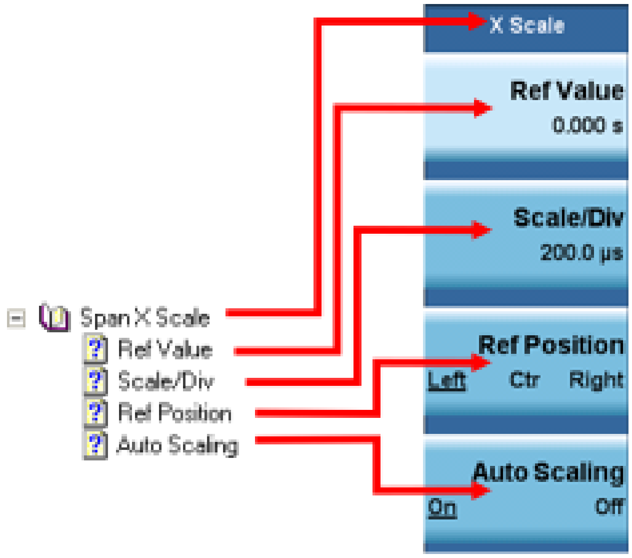
The Contents section for each Measurement is sub-divided into topics for each Front-panel key, in alphabetical order, as shown below.



If you don't see a topic for a Front-panel key in the Measurement-specific section, then it is located in the section "System Functions" on page 68.

Key Information for Softkeys

Information for each softkey that appears when you press a Front-panel key (or a softkey with a submenu) is listed under the entry for that key in the Help Contents. The example below shows the submenu under the **SPAN X Scale** Front-panel key in the "Waveform" Measurement, alongside the actual softkeys for that menu.



In these subsections, all softkeys are listed in the order they appear in their menu (that is, **not** in alphabetical order).

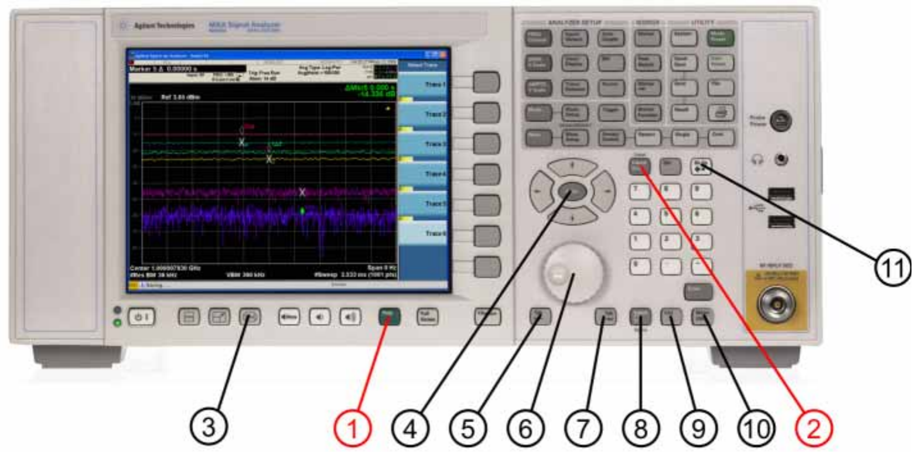
Common Measurement Functions

This section groups together function and key information that is shared between measurements. However, there is a listing for every Front-panel key and subkey in the section for each measurement, so you will generally not need to refer to this section.

The key subsections are listed alphabetically.

Front Panel Keys used by the Help System

The interactive Help system uses the Front-panel keys shown below.

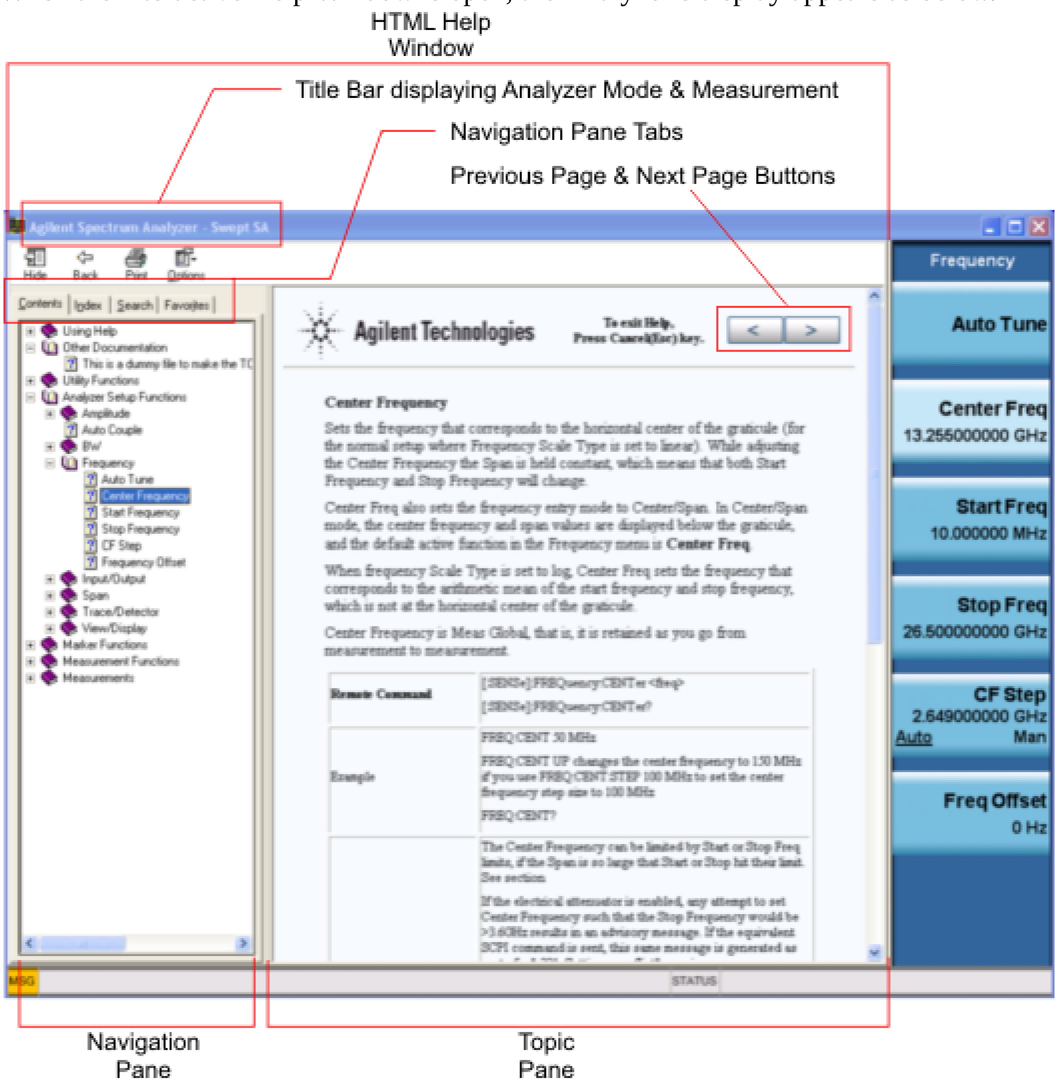


Item #	Item Name	Description
1	Help Key	Opens Help (displaying the topic for the last key pressed).
2	Cancel (Esc) Key	Exits Help.
3	Next Window Key	Changes the current window pane selection.
4	Arrow / Enter Keys	A central **Enter** key, surrounded by four directional arrow keys. Navigates within the Help system.
5	Backward Tab Key	Moves between controls in the Help display.
6	Knob	For future use.
7	Forward Tab Key	Moves between controls in the Help display.
8	Select / Space Key	Navigates within the Help system, in conjunction with other keys.
9	Ctrl Key	Navigates within the Help system, in conjunction with other keys. See “Navigating Windows HTML Help (CHM) Files” on page 72.
10	Alt Key	Navigates within the Help system, in conjunction with other keys. See “Navigating Windows HTML Help (CHM) Files” on page 72.
11	Bk Sp (Backspace) Key	Acts as a "Back" key when navigating the pages of the Help system.

Navigating Windows HTML Help (CHM) Files

HTML Help Window Components

When the interactive Help Window is open, the Analyzer’s display appears as below.



The HTML Help Window appears on top of, and to the left of, the measurement display. You can still see and use the current softkey menu when the HTML Help Window is open. However, pressing a softkey when the Help window is open displays Help for that softkey, but does **not** execute the softkey’s function.

When the Help Window is open, the Analyzer retains its current Mode and Measurement, as shown in the Title Bar.

The HTML Help Window itself consists of two panes, as shown in the diagram above.

On the left is the Navigation Pane, and on the right is the Topic Pane.

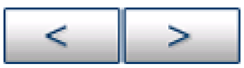
The Help Window Navigation Pane

The Navigation Pane is further divided into four tabs: Contents, Index, Search and Favorites, as shown below.

For details of how to switch between these tabs, if you don’t have a mouse attached to the Analyzer, see the Section “To Switch the Active Tab within the Navigation Pane” on page 76.

The Help Window Topic Pane

This pane displays the text for the topic that you have selected. It also contains clickable **Previous Page** and **Next Page** buttons (as shown below), which can be used to move to the previous or next page in the Help file.



Basic Help Window Operations

This topic contains the following sections:

To locate the keys mentioned in this section, see “Front Panel Keys used by the Help System” on page 71.

Opening Help

To access the Help system, press the green **Help** key below the front panel display (shown below) while an Agilent application is running.

Note that the softkeys remain visible when the Help window is open.

Getting Help for a Specific Key

1. If the Help window **is** already open, press the desired key. The relevant Help topic appears.

   Note that the function normally invoked by the key is **not** executed when the key is pressed with the Help window open. If you want to execute the key’s function, first close Help by pressing the **Cancel (Esc)** key (as described in “Closing the Help Window” on page 74), then press the key, before opening Help again (if required).

2. If the Help window is **not** already open, press the desired key (which executes the key’s function), then press the **Help** key to display the relevant Help page. Help is available for all softkeys, and for

all the Front-panel keys listed under the "System Functions" and "Measurement" sections.

For details of how to navigate within the panes of the Help window, see "Navigating Windows HTML Help (CHM) Files" on page 72.

Closing the Help Window

To close the Help window, and return to the measurement application, press the **Cancel (Esc)** key (depicted below).

Viewing Help on How to Use Help

With the Help window open, press the green **Help** key again.

The "Using Help" page appears, as shown below.

Exiting Help on How to Use Help

See the Section "To Go Back or Forward: display the Previously-viewed or Next-viewed Topic in the Topic Pane" on page 78 for details of several methods to accomplish this.

Navigating the Help Window

The way you navigate around the HTML Help Window depends on whether you have a mouse and keyboard attached to your Analyzer:

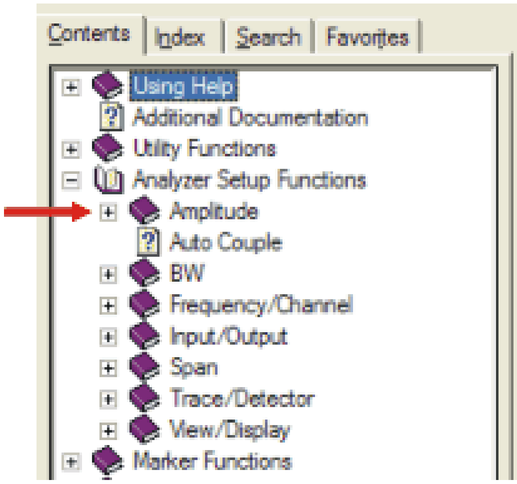
- If you have a mouse and keyboard attached, see the Section "Navigating the Help Window with a Mouse" on page 74.
- If you don't have a mouse and keyboard attached, see the Section "Navigating the Help Window Without a Mouse" on page 76.

Navigating the Help Window with a Mouse

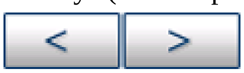
When the HTML Help window is open, you can point-and-click to navigate, as you would when using Help for any Microsoft Windows computer application. The basic navigational features the Help systems of all X-Series Analyzers are as follows:

- If necessary, press the green **Help** key on the Front Panel, as described in "Opening Help" on page 73, to open the HTML Help window.

- Choose the desired topic from the list under the Contents Tab of the HTML Help Window's Navigation Pane, then click on the topic title to display the first page of the topic.
- To expand the listing of a topic, click on the + icon to the left of the topic's book icon, as shown below. A list of subtopics and pages appears.

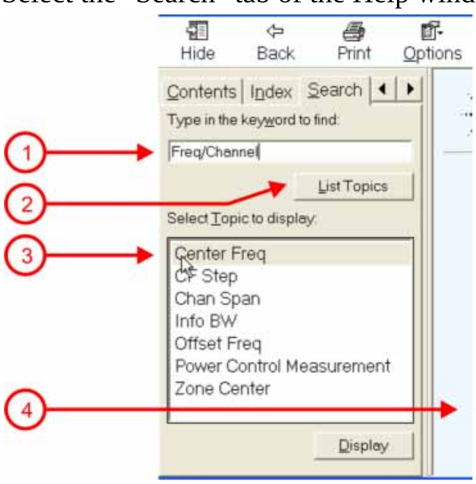


- To move to the Next or Previous Page within the Topic Pane, click the **Next Page** or **Previous Page** Keys (at the top right of the **Topic** Pane), as shown below.



Searching for a Help Topic If you also have a keyboard attached to the Analyzer, you can use the Help system's full-text search feature to locate help for any topic, by typing in a key name, a topic name, or any other desired text.

Select the "Search" tab of the Help window's Navigation Pane, then use the following procedure:



1. Type the desired topic name into the Search window as shown in the diagram above. Note that the text search is **not** case-sensitive.
2. Click on the **List Topics** button.
3. **Either**:

   Double-click on the desired topic in the list,

Or:

Click on the desired topic to select it, then click the **Display** button beneath the list.

4. The topic is then displayed in the Topic Pane (right-hand side of display).

Navigating the Help Window Without a Mouse

Most features of the Help system can be accessed and navigated without the necessity to attach a mouse or keyboard to the Analyzer. There are, however, a few exceptions to this rule, which are noted in the Section “Functions that cannot be used without a Mouse and Keyboard” on page 79.

For information about how to perform common tasks in the Help system, click on one of the following links:

“To Toggle the Focus between the Navigation Pane and the Topic Pane” on page 76

“To Switch the Active Tab within the Navigation Pane” on page 76

“To Scroll up or down the list of Topics within the Contents or Index Tabs of the Navigation Pane” on page 77

“To Expand or Collapse a selected topic within the Contents Tab of the Navigation Pane” on page 77

“To Display a selected Help topic in the Topic Pane from the Contents Tab of the Navigation Pane” on page 77

“To Display a Help topic in the Topic Pane from the Index Tab of the Navigation Pane” on page 77

“To Scroll up or down within a topic in the Topic Pane” on page 77

“To Go to the Next or Previous Page in the Topic Pane” on page 78

“To Go Back or Forward: display the Previously-viewed or Next-viewed Topic in the Topic Pane” on page 78

“To Scroll horizontally or vertically within the Contents Tab of the Navigation Pane” on page 79

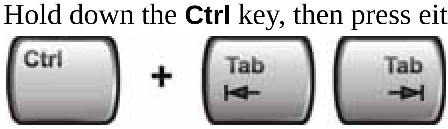
“To Print the topic currently displayed” on page 79

To locate all the keys mentioned in this section, see “Front Panel Keys used by the Help System” on page 71.

To Toggle the Focus between the Navigation Pane and the Topic Pane Press the **Next Window** key.

To Switch the Active Tab within the Navigation Pane Perform this procedure to display either the Contents, Index, Search or Favorites tab of the Help window’s Navigation Pane.

Hold down the **Ctrl** key, then press either the **Forward Tab** key, **or** the **Backward Tab** key.



To Scroll up or down the list of Topics within the Contents or Index Tabs of the Navigation Pane

With the focus in the Navigation Pane, press the **Up Arrow** or **Down Arrow** keys.

To Expand or Collapse a selected topic within the Contents Tab of the Navigation Pane With the focus in the Navigation Pane, press the **Right Arrow** key to **expand** the selected topic:

Or press the **Left Arrow** key to **collapse** the selected topic.

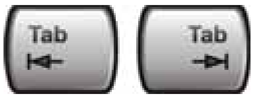
To Display a selected Help topic in the Topic Pane from the Contents Tab of the Navigation Pane

With the focus in the Contents Tab of the Navigation Pane, press the **Enter** key. If the selected topic was not already expanded, it expands in the Navigation Pane.

To Display a Help topic in the Topic Pane from the Index Tab of the Navigation Pane With the focus in the Index Tab of the Navigation Pane, press the **Enter** key.

To Scroll up or down within a topic in the Topic Pane With the focus in the Topic Pane, press either the **Up Arrow** key or **Down Arrow** key.

To Go to the Next or Previous Page in the Topic Pane With the focus in the Topic Pane, press either **Forward Tab** or **Backward Tab** keys



to select the **>** (**Next Page**) key at the top right of the Pane, if you want to go to the **next** page,

or select the **<** (**Previous Page**) key at the top right of the Pane, if you want to go to the **previous** page.

Press **Enter**.

To Go Back or Forward: display the Previously-viewed or Next-viewed Topic in the Topic Pane

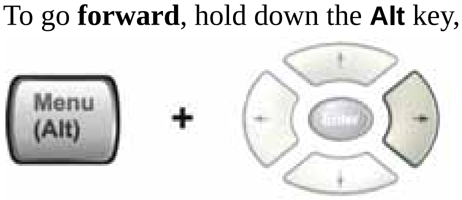
To go **back**, **either**:

Hold down the **Alt** key, then press the **Left Arrow** key.

Or:

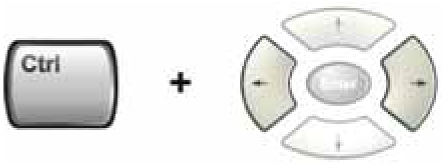
Press the **Bk Sp** key.

To go **forward**, hold down the **Alt** key, then press the **Right Arrow** key.

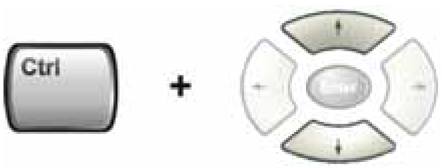


(The "Go Forward" operation has no effect unless there have been previous “Go Back” operations)

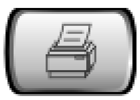
To Scroll horizontally or vertically within the Contents Tab of the Navigation Pane To scroll **horizontally**: with the focus in the Contents Tab of the Navigation Pane, hold down the **Ctrl** key, then press either the **Left Arrow** or **Right Arrow** keys.



To scroll **vertically**: with the focus in the Contents Tab of the Navigation Pane, hold down the **Ctrl** key, then press either the **Up Arrow** or **Down Arrow** keys.



To Print the topic currently displayed Press the Front-panel **Print** key



Functions that cannot be used without a Mouse and Keyboard The following parts of the HTML Help System **cannot** easily be used without attaching a mouse and keyboard to the Analyzer.

- The menu options at the top of the Help Window, consisting of: **Hide**, **Back**, **Print** and **Options**.
- The functionality of the Search Tab of the Navigation Pane.
- The functionality of the Favorites Tab of the Navigation Pane.

Navigating Acrobat (PDF) Files

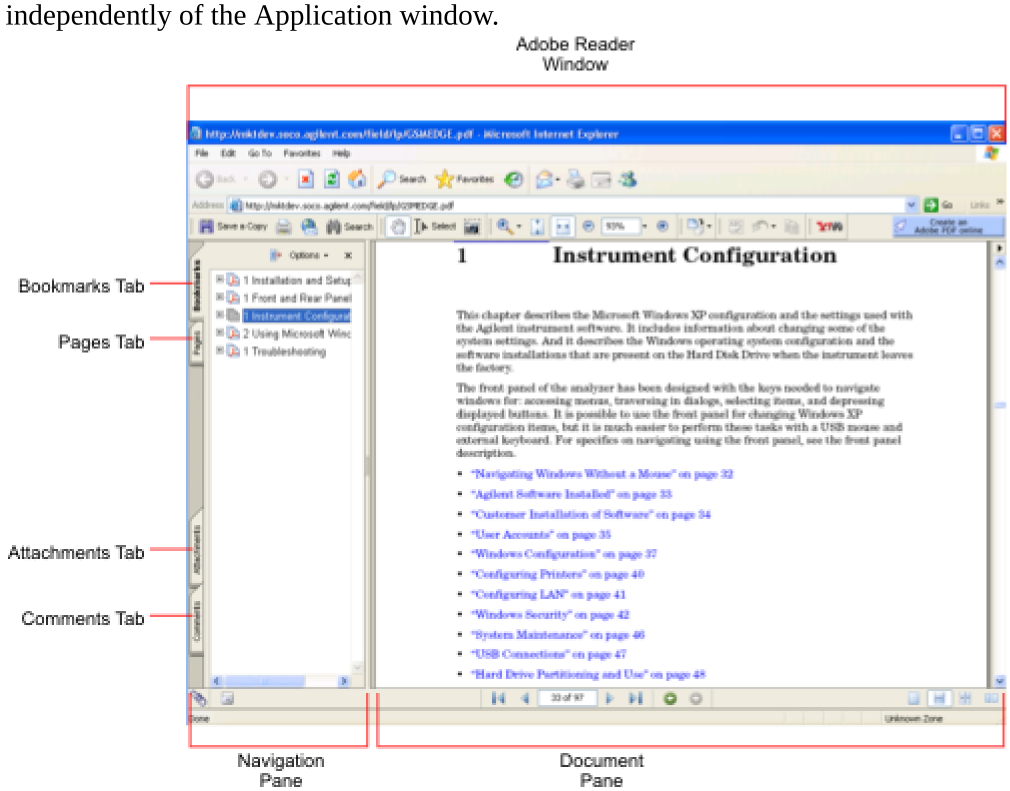
IMPORTANT To navigate PDF files effectively, you must attach a mouse and keyboard to the Analyzer.

If it is not possible to attach a mouse and keyboard to the Analyzer, you should copy the PDF file to a separate computer, then open it on that computer. Every PDF file that is present on the Analyzer's hard disk can also be found on the Documentation CD shipped with the Analyzer. For details, see "Copying the Acrobat (PDF) Files" on page 66.

Adobe Reader Window

When an Adobe Acrobat (PDF) file is open and being viewed, the Analyzer's display appears as below.

Note that, unlike the HTML Help Window, the Acrobat Reader Window is **not** embedded in the Analyzer's Application window. It is a separate window, which can be resized, moved and closed independently of the Application window.



The Adobe Reader Window itself consists of two panes, as shown in the diagram above.

On the left is the Navigation Pane (which may be hidden), and on the right is the Document Pane.

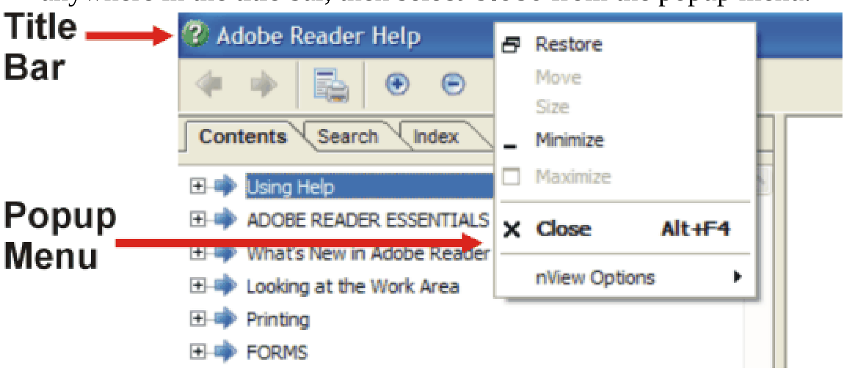
The Navigation Pane is further subdivided into four tabs: Bookmarks, Pages, Attachments and Comments. Typically, PDF files supplied with the Agilent X-Series Analyzers contain useful content only under the Bookmarks and Pages Tabs: the Attachments and Comments Tabs are not used.

Navigating the Acrobat Reader Window

The online Help for Adobe Reader provides detailed information on how to use the Reader. To access the online Help, do the following:

- With the Adobe Reader window open, click **Help**, **Adobe Reader Help** in the menu at the top of the screen. This opens the Help window on top of the document window.
- To close the Help window, **either** click the Red **X** at the top right of the window, **or** right-click

anywhere in the title bar, then select **Close** from the popup menu.



Printing Acrobat Files

NOTE	The driver for the appropriate printer must be installed on the Analyzer’s hard disk before any file can be printed.

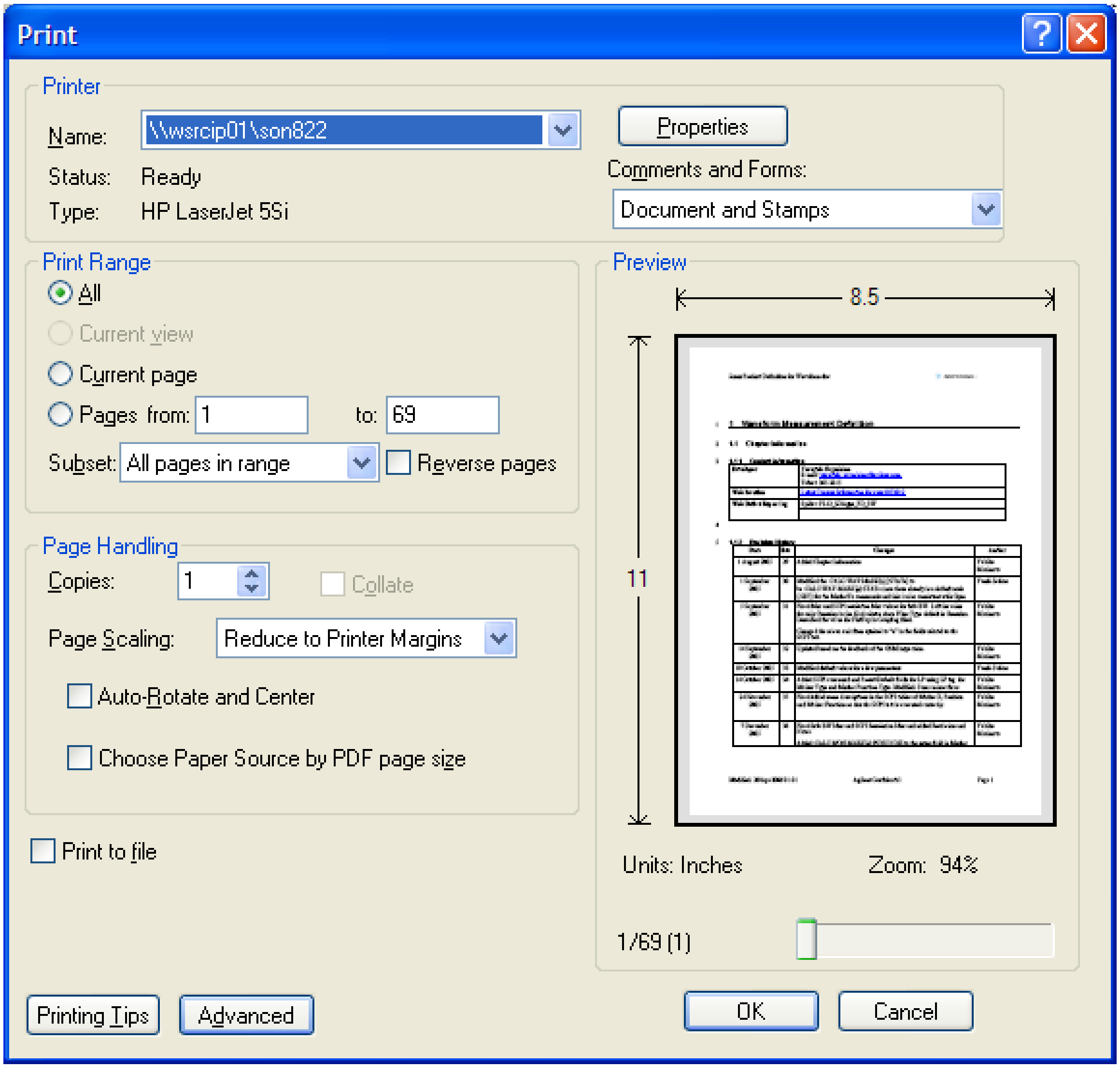
To print all or part of an open Acrobat file, do the following.

1. **Either**,

   a. click on the `Print` icon in the Acrobat Reader toolbar,

   b. **or**, select `File > Print` from the menu.

2. The Acrobat Reader Print dialog opens, as shown below.



3. Choose the desired options within the Print dialog, then click `OK` to print (or click `Cancel` to cancel the printing).

NOTE	Clicking the `Properties` button within the Print dialog opens a window containing controls that are specific to the printer model installed. Check the printer manufacturer's documentation for details of these capabilities.

Terms Used in This Documentation

Many special terms are used throughout this documentation. Please refer to the "Getting Started Guide" for detailed explanations of all these terms.

The Section below provides a brief description of special terms used in the Key parameter tables.

Terms used in Key Parameter Tables

The following terms are used in the parameter tables for each front-panel key or softkey. However, a particular key description may not use all the terms listed.

Term	**Meaning**
Default Unit	The default measurement unit of the setting.
Default Terminator	Indicates the units that will be attached to the numeric value that you have entered. This default will be used from the front panel, when you terminate your entry by pressing the **Enter** key, rather then selecting a units key. This default will be used remotely when you send the command without specifying any units after your value(s).
Dependencies/ Couplings	Some commands may be unavailable when other parameters are set in certain ways. If applicable, any such limitations are described here.
Example	Provides command examples using the indicated remote command syntax.
Factory Preset	Describes the function settings after a **Factory Preset**.
Key Path	The sequence of Front-panel keys that accesses the function or setting.
Knob Increment/Decrement	The numeric value of the minimum increment or decrement that is applied when turning the thumb wheel knob.
Max	The Maximum numerical value that the setting can take.
Min	The Minimum numerical value that the setting can take.
Meas Global	The functionality described is the same in all measurements.
Meas Local	The functionality described is only true for the measurement selected.
Mode Global	The functionality described is the same for all modes.
Preset	In some cases, a Preset operation changes the status of a parameter. If the operation of the key specified is modified by a Preset operation, the effect is described here.
Range	Describes the range of the smallest to largest values to which the function can be set. If you try to set a value below the minimum value, the analyzer defaults to the minimum value. If you try to set a value above the maximum value, the analyzer defaults to the maximum value.
Remote Command	Shows the syntax requirements for each SCPI command.

Term	Meaning
Remote Command Notes	Additional notes regarding Remote Commands.
Resolution	Specifies the smallest change that can be made to the numeric value of a parameter.
SCPI Status Bits/OPC Dependencies	Pressing certain keys may affect one or more status bits. If applicable, details are given here.
State Saved	Indicates what happens to a particular function when the Analyzer state is saved (either to an external memory device or the internal D: drive). It also indicates whether the current settings of the function are maintained if the Analyzer is powered on or preset using **Power On Last State** or **User Preset**.

Context Sensitive Help not Available

You have been directed to this page because interactive help for the key you selected is not available.

The following information may help you to find related topics of interest:

- If your Analyzer has an attached Mouse and Keyboard, see the Section "Searching for a Help Topic" on page 75.
- If your Analyzer does **not** have an attached Mouse and Keyboard, see the Section "Finding a Topic without a Mouse and Keyboard" on page 85 below.
- If you want to learn how to select on-page links **without** a Mouse attached to your Analyzer, see the Section "Selecting a Hyperlink without a Mouse" on page 86 below.

TIP If you want to understand the organization of Help, see the Section "How Help is Organized" on page 68.

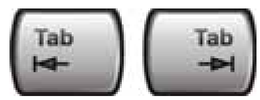
Finding a Topic without a Mouse and Keyboard

Follow this procedure when you want to display a different Help topic by selecting it from the Contents tab of the Help window's Navigation Pane, but you do not have a mouse attached to the Analyzer.

Perform this action:	Using these keys:
1. If necessary, toggle the focus between the Contents tab of the Navigation Pane (left side of display) and the Topic Pane (right side of display) by pressing the **Next Window** key. Ensure that the focus is in the **Contents tab of the Navigation** Pane.	
2. Move up or down the Contents list, by pressing the **Up Arrow** or **Down Arrow** keys. Topics become highlighted upon selection.	
3. Display the selected topic, by pressing the **Enter** key.	

Selecting a Hyperlink without a Mouse

Follow this procedure when you want to select and follow a hyperlink on a Help page, but you do not have a mouse attached to the Analyzer.

Perform this action:	**Using these keys:**
1. If necessary, toggle the focus between the Contents tab of the Navigation Pane (left side of display) and the Topic Pane (right side of display) by pressing the **Next Window** key. Ensure that the focus is in the **Topic Pane**.	
2. Move from link to link in the Topic Pane (right side of display) by pressing the **Forward Tab** and **Backward Tab** keys. Links become highlighted upon selection. NOTE: When a Help page is first displayed, no link is selected. Clicking the **Forward Tab** key once selects the **Previous Page** key. Clicking the **Forward Tab** key a second time selects the **Next Page** key. Clicking the **Forward Tab** key for a third time selects the first hyperlink on the page. It is sometimes difficult to see the highlighting of the **Previous** and **Next Page** keys.	Use the **Forward** and **Backward Tab** keys  to select the **Previous** and **Next Page** keys 
3. When you have selected the desired link, activate it by pressing the **Enter** key.	

2 Additional Documentation

This section lists all available documentation for the X-Series Signal Analyzers.

All the documents listed in this section are installed on this Analyzer's hard disk, and may be opened by clicking on one of the links. All the documents are also included on the Documentation CD shipped with your Analyzer.

For details of the types of documentation available, see "Documentation Categories" on page 88.

NOTE If you do **not** have a mouse attached to your Analyzer, you may be unable to navigate or close PDF and CHM documents opened by the links on these pages. In this case, it is recommended that you should copy the PDF or CHM file to another computer that has an attached mouse.

The available documentation is divided into 3 groups as listed below. Click on a link for a detailed list of the documents in each group.

Documentation Categories

All available documentation for X Series Analyzers falls into one of the following categories.

Type	Description
Getting Started Guide	Turn on process, Windows XP use/configuration, Front and Rear panel.
Specifications Guide	Specifications for all available Measurement Applications and optional hardware (for example, Spectrum Analyzer and W-CDMA).
Functional Testing Guide	Quick checks to verify overall instrument operation.
Instrument Messages	Descriptions of displayed messages of Information, Warnings and Errors.
Measurement Guide	Includes examples of measurements made using the front panel keys, or over a remote interface.
Programmer's Guide	Provides information about how to program Agilent X-Series Signal Analyzers with SCPI, and explains how to use the programming documentation. Describes programming examples, which are available in several languages.
User's and Programmer's Reference	Descriptions of front panel key functionality and the corresponding SCPI commands. Also includes some concept information.

For All Measurement Applications

Click on any of the links below to open the document in a new window.

- Getting Started Guide [PDF]
- EXA Specifications Guide [PDF]
- MXA Specifications Guide [PDF]
- Instrument Messages Guide [PDF]
- CXA Functional Tests Guide [PDF]
- EXA Functional Tests Guide [PDF]
- MXA Functional Tests Guide [PDF]
- Programmer's Guide [PDF]
- Programming Examples [Windows Explorer Folder]
- Programming Conversion Guide [PDF]

For details of the types of documentation available, see "Documentation Categories" on page 88.

Back to "Additional Documentation" on page 87.

For Specific Measurement Applications

For a list of links to all documents for a specific Measurement Application, click on one of the links below.

- N6149A-2FP iDEN/WiDEN/MotoTalk Measurement Application
- N6153A-2FP DVB-T/H Measurement Application
- N6155A-2FP ISDB-T Measurement Application
- N6156A-2FP DTMB Measurement Application
- N6158A-2FP CMMB Measurement Application
- N9020A/N9010A IQ Analyzer Measurement Application
- N9020A/N9010A Spectrum Analyzer Measurement Application
- N9061A Remote Language Compatibility Application
- N9063A Analog Demod Measurement Application
- N9068A Phase Noise Measurement Application
- N9069A Noise Figure Measurement Application
- N9071A GSM-EDGE Measurement Application
- N9072A cdma2000 Measurement Application
- N9073A W-CDMA Measurement Application
- N9074A-XFP Single Acquisition Combined Fixed WiMAX Measurement Application
- N9075A 802.16 OFDMA (WiMAX/WiBro) Measurement Application
- N9076A 1xEV-DO Measurement Application
- N9077A-XFP Single Acquisition Combined WLAN Measurement Application
- N9079A TD-SCDMA Measurement Application
- N9080A LTE FDD Measurement Application
- N9082A LTE TDD Measurement Application
- 89601X Vector Signal Analyzer Measurement Application

Back to “Additional Documentation” on page 87.

N6149A-2FP iDEN/WiDEN/MotoTalk Measurement Application

- User’s & Programmer’s Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to "Additional Documentation" on page 87.

N6153A-2FP DVB-T/H Measurement Application

- User's & Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see "Documentation Categories" on page 88.

Back to "Additional Documentation" on page 87.

N6155A-2FP ISDB-T Measurement Application

- User's & Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see "Documentation Categories" on page 88.

Back to "Additional Documentation" on page 87.

N6156A-2FP DTMB Measurement Application

- User's & Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see "Documentation Categories" on page 88.

Back to "Additional Documentation" on page 87.

N6158A-2FP CMMB Measurement Application

- User's & Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see "Documentation Categories" on page 88.

Back to "Additional Documentation" on page 87.

N9020A/N9010A IQ Analyzer Measurement Application

- User's & Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see "Documentation Categories" on page 88.

Back to "Additional Documentation" on page 87.

N9020A/N9010A Spectrum Analyzer Measurement Application

- User's & Programmer's Reference [PDF]

- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9061A Remote Language Compatibility Application

- Remote Language Compatibility Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9063A Analog Demod Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9068A Phase Noise Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9069A Noise Figure Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9071A GSM-EDGE Measurement Application

- User's and Programmer's Reference [PDF]
- Single Acquisition Combined GSM Measurement Application [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9072A cdma2000 Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide and Programming Examples [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9073A W-CDMA Measurement Application

- User's and Programmer's Reference [PDF]
- Single Acquisition Combined W-CDMA Measurement Application [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9074A-XFP Single Acquisition Combined Fixed WiMAX Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9075A 802.16 OFDMA (WiMAX/WiBro) Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9076A 1xEV-DO Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9077A-XFP Single Acquisition Combined WLAN Measurement Application

- User's and Programmer's Reference [PDF]

- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9079A TD-SCDMA Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9080A LTE FDD Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

N9082A LTE TDD Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

89601X Vector Signal Analyzer Measurement Application

- User's and Programmer's Reference [PDF]
- Measurement Guide [PDF]

For details of the types of documentation available, see “Documentation Categories” on page 88.

Back to “Additional Documentation” on page 87.

Application Notes & Other Documentation

Click on any of the links below to open the document in a new window.

- AN-57-1: Fundamentals of RF and Microwave Noise Figure Measurements [PDF]
- AN-57-2: Noise Figure Measurement Accuracy - The Y-Factor [PDF]
- AN-150: Spectrum Analysis Basics [PDF]
- AN-1325: Performing cdma2000 Measurements Today [PDF]
- AN-1355: Designing & Testing 3GPP W-CDMA Base Transceiver Stations [PDF]
- AN-1356: Designing & Testing 3GPP W-CDMA User Equipment [PDF]
- AN-1357: Designing and Testing cdma2000 Base Stations [PDF]
- AN-1358: Designing and Testing cdma2000 Mobile Stations [PDF]
- AN-1398: Forward Link Measurements for 1xEV-DO Access Networks [PDF]
- AN-1414: Understanding Measurements of 1xEV-DO Access Terminals [PDF]
- AN-1583: Maximizing Measurement Speed with Agilent's X-Series Signal Analyzers [PDF]
- AN-1585: Using the Agilent MXA Signal Analyzer for Measuring and Troubleshooting Digitally Modulated Signals [PDF]
- Agilent 3GPP Long Term Evolution Application Note [PDF]
- Agilent I/O Libraries - E2094Q [PDF]
- Agilent Preamplifiers and System Noise Figure Application Note [PDF]
- HSDPA and HSUPA Concepts [PDF]
- Tips for Preventing Spectrum Analyzer Damage [PDF]
- 802.16e WiMax OFDMA Signal Measurements & Troubleshooting [PDF]
- 89601X VXA Application Note Library [CHM]
- VISA User’s Guide for IO Libraries Suite

Back to Additional Documentation.

3 About the Analyzer

The X-Series signal analyzer measures and monitors complex RF and microwave signals. Analog baseband analysis is available on MXA. The analyzer integrates traditional spectrum measurements with advanced vector signal analysis to optimize speed, accuracy, and dynamic range. The analyzer has Windows XP Pro® built in as an operating system, which expands the usability of the analyzer.

With a broad set of applications and demodulation capabilities, an intuitive user interface, outstanding connectivity and powerful one-button measurements, the analyzer is ideal for both R&D and manufacturing engineers working on cellular, emerging wireless communications, general purpose, aerospace and defense applications.

Installing Application Software

When you want to install a measurement application after your initial hardware purchase, you actually only need to license it. All of the available applications are loaded in your analyzer at the time of purchase.

So when you purchase an application, you will receive an entitlement certificate that is used to obtain a license key for that particular measurement application. Enter the license key that you obtain into the Signal Analyzer to activate the new measurement application. See below for more information.

For the latest information on Agilent Signal Analyzer measurement applications and upgrade kits, visit the following internet URL.

http://www.agilent.com/find/sa_upgrades

Viewing a License Key

Measurement personalities purchased with your instrument have been installed and activated at the factory before shipment. The instrument requires a unique **License Key** for every measurement application purchased. The license key is a hexadecimal string that is specific to your measurement application, instrument model number and serial number. It enables you to install, or reactivate that particular application.

Press **System**, **Show**, **System** to display which measurement applications are currently licensed in your analyzer.

Go to the following location to view the license keys for the installed measurement applications:

C:\Programing Files\Agilent\Licensing

NOTE You may want to keep a copy of your license key in a secure location. You can print out a copy of the display showing the license numbers to do this. If you should lose your license key, call your nearest Agilent Technologies service or sales office for assistance.

Obtaining and Installing a License Key

If you purchase an additional application that requires installation, you will receive an “Entitlement Certificate” which may be redeemed for a license key for one instrument. Follow the instructions that accompany the certificate to obtain your license key.

Installing a license key for the selected application can be done automatically using a USB memory device. To do this, you would put the license file on the USB memory device at the root level. Follow the instructions that come with your software installation kit.

Installing a license key can also be done manually using the license management application in the instrument. It is found through the instrument front panel keys at **System**, **Licensing. . .** , or internally at C:\Programming Files\Agilent\Licensing.

NOTE	You can also use these procedures to reinstall a license key that has been accidentally deleted, or lost due to a memory failure.

Missing and Old Measurement Application Software

All the software applications were loaded at the time of original instrument manufacture. It is a good idea to regularly update your software with the latest available version. This assures that you get any improvements and expanded functionality that is available.

Because the software was loaded at the initial purchase, there may be additional measurement applications that are now available. If the application you are interested in licensing is not available, you will need to do a software update. (Press **System**, **Show**, **System**.)

Check the Agilent internet website for the latest software versions available for downloading:

http://www.agilent.com/find/pxa_software
http://www.agilent.com/find/mxa_software
http://www.agilent.com/find/exa_software
http://www.agilent.com/find/cxa_software

You must load the updated software package into the analyzer from a USB drive, or directly from the internet. An automatic loading program is included with the files.

X-Series Options and Accessories

MXA Instrument Options

Product	Description
N9020A	MXA Signal Analyzer
N9020A-503	Frequency range from 20 Hz to 3.6 GHz
N9020A-508	Frequency range from 20 Hz to 8.4 GHz
N9020A-513	Frequency range from 20 Hz to 13.6 GHz
N9020A-526	Frequency range from 20 Hz to 26.5 GHz
N9020A-B25	Analysis bandwidth, 25 MHz
N9020A-BBA	Analog baseband IQ inputs
N9020AK-SU1	Baseband bandwidth from 25 to 40 MHz (upgrade)
N9020AK-PC2	Dual-Core CPU Processor with Removable Hard Drive (upgrade)
N9020AK-ALL	Amplitude Corrections and Limit Lines Features (upgrade)
N9020A-SSD	Removable Solid State Drive Substitution
N9020A-HDD	Additional Removable Hard Drive (160 GB)
N9020A-PFR	Precision frequency reference
N9020A-PRC	Portable configuration
N9020A-EA3	Electric attenuator, 3.6 GHz
N9020A-EMC	Precompliance EMI Measurement
N9020A-S40	Baseband analysis bandwidth, 40 MHz/channel
N9020A-P03	Preamplifier, 3.6 GHz
N9020A-P08	Preamplifier, 8.4 GHz
N9020A-P13	Preamplifier, 13.6 GHz

Product	Description
N9020A-P26	Preamplifier, 26.5 GHz

MXA Accessories

Product	Description
N9020A-MLP	75 ohm minimum loss pad
N9020A-EFM	USB flash drive
N9020A-DVR	DVD-ROM drive
N9020A-MSE	Mouse, USB interface
N9020A-KYB	Keyboard, USB interface
N9020A-HTC	Hard transit case
N9020A-1CP	Rackmount kit with handles
N9020A-1CN	Front handle kit
N9020A-1CM	Rackmount kit
N9020A-1CR	Rack slide kit
N9020A-UK6	Commercial Calibration Certificate with Test Data
N9020A-1A7	ISO 17025 Compliant Calibration
N9020A-A6J	ANSI Z540 Compliant Calibration

EXA Instrument Options

Product	Description
N9010A	EXA Signal Analyzer (3.6, 7.0, 13.6, and 26.5 GHz)
N9010A-503	Frequency range from 9 kHz to 3.6 GHz
N9010A-507	Frequency range from 9 kHz to 7.0 GHz
N9010A-513	Frequency range from 9 kHz to 13.6 GHz
N9010A-526	Frequency range from 9 kHz to 26.5 GHz
N9010A-B25	Analysis bandwidth, 25 MHz
N9010A-FSA	Fine step attenuator
N9010A-ALL	Amplitude Corrections and Limit Lines Features (upgrade)
N9010A-SSD	Removable Solid State Drive Substitution
N9010A-PC2	Dual-Core Processor with Removable Hard Drive
N9010A-HDD	Additional Removable Hard Drive (160 GB)

Product	Description
N9010A-CPU	Instrument Security, Additional CPU & HDD
N9010A-PFR	Precision frequency reference
N9010A-EA3	Electric attenuator, 3.6 GHz
N9010A-EMC	Precompliance EMI Measurement
N9010A-P03	Preamplifier, 3.6 GHz

EXA Accessories

Product	Description
N9010A-PRC	Portable Configuration
N9010A-MLP	Minimum loss pad, 50 to 75 ohms
N9010A-EFM	USB flash drive
N9010A-DVR	DVD-ROM/CD-R/RW drive
N9010A-MSE	Mouse, USB interface
N9010A-KYB	Keyboard, USB interface
N9010A-HTC	Hard transit case
N9010A-1CP	Rackmount kit with handles
N9010A-1CN	Front handle kit
N9010A-1CM	Rackmount kit
N9010A-1CR	Rack slide kit
N9010A-UK6	Commercial Calibration Certificate with Test Data
N9010A-1A7	ISO 17025 Compliant Calibration
N9010A-A6J	ANSI Z540 Compliant Calibration

CXA Instrument Options

Product	Description
N9000A	CXA Signal Analyzer (3.0, 7.5 GHz)
N9000A-503	Frequency range from 9 kHz to 3.0 GHz
N9000A-507	Frequency range from 9 kHz to 7.5 GHz
N9000A-PRC	Portable configuration
N9000A-600	Benchtop configuration
N9010A-FSA	Fine step attenuator

Product	Description
N9000A-EMC	EMC Basic Precompliance EMI features
N9000A-P03	Preamplifier, 3.0 GHz
N9000A-P07	Preamplifier 7.5 GHz

CXA Accessories

Product	Description
N9000A-MLP	Minimum loss pad, 50 to 75 ohms
N9000A-EFM	USB flash drive
N9000A-DVR	DVD-ROM/CD-R/RW drive
N9000A-MSE	Mouse, USB interface
N9000A-KYB	Keyboard, USB interface
N9000A-KB2	Smaller keyboard, USB interface
N9000A-HTC	Hard transit case
N9000A-1CP	Rackmount kit with handles
N9000A-1CN	Front handle kit
N9000A-1CM	Rackmount kit
N9000A-1CR	Rack slide kit
N9000A-UK6	Commercial Calibration Certificate with Test Data
N9000A-1A7	ISO 17025 Compliant Calibration
N9000A-A6J	ANSI Z540 Compliant Calibration

Advanced Measurement Application Software

For a current list of application software, go to the following URLs.

For PXA,

http://www.agilent.com/find/pxa/options

Select the **PXA N9030A, Options and Measurement Applications** link on the top of the page.

For MXA,

http://www.agilent.com/find/mxa/options

Select the **MXA N9020A, Options and Measurement Applications** link on the top of the page.

For EXA,

http://www.agilent.com/find/exa/options

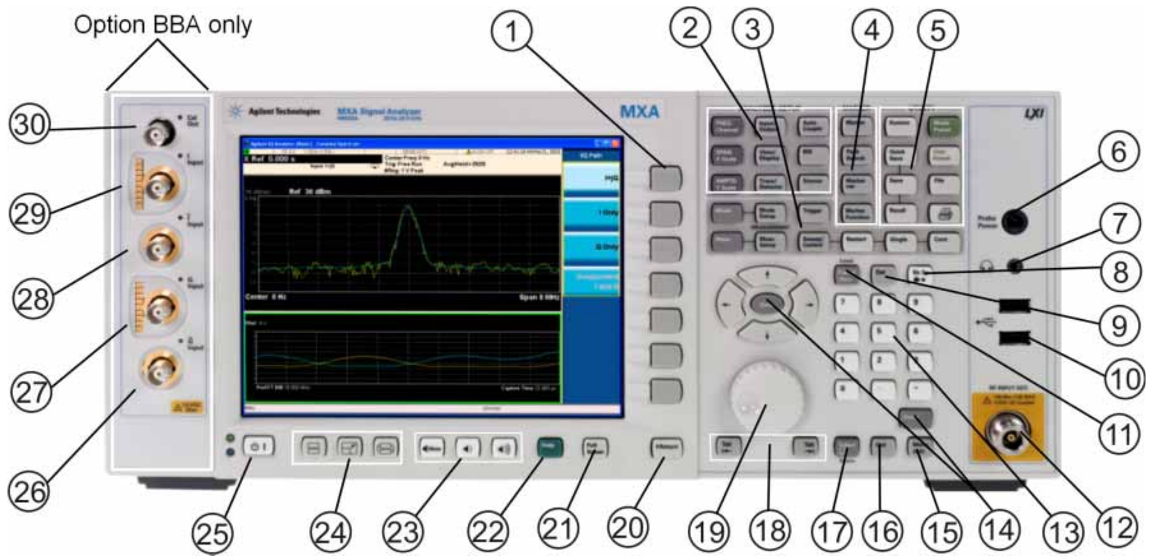
Select the **EXA N9010A, Options and Measurement Applications** link on the top of the page.

For CXA,

http://www.agilent.com/find/cxa/options

Select the **CXA N9000A, Options and Measurement Applications** link on the top of the page.

Front-Panel Features



Item		Description
#	Name	
1	Menu Keys	Key labels appear to the left of the menu keys to identify the current function of each key. The displayed functions are dependent on the currently selected Mode and Measurement, and are directly related to the most recent key press.
2	Analyzer Setup Keys	These keys set the parameters used for making measurements in the current Mode and Measurement.
3	Measurement Keys	These keys select the Mode, and the Measurement within the mode. They also control the initiation and rate of recurrence of measurements.
4	Marker Keys	Markers are often available for a measurement, to measure a very specific point/segment of data within the range of the current measurement data.
5	Utility Keys	These keys control system-wide functionality such as: • instrument configuration information and I/O setup, • printer setup and printing, • file management, save and recall, • instrument presets.
6	Probe Power	Supplies power for external high frequency probes and accessories.
7	Headphones Output	Headphones can be used to hear any available audio output.
8	Back Space Key	Press this key to delete the previous character when entering alphanumeric information. It also works as the Back key in Help and Explorer windows.

Item		Description
#	Name	
9	Delete Key	Press this key to delete files, or to perform other deletion tasks.
10	USB Connectors	Standard USB 2.0 ports, Type A. Connect to external peripherals such as a mouse, keyboard, DVD drive, or hard drive.
11	Local/Cancel/(Esc) Key	If you are in remote operation, Local: • returns instrument control from remote back to local (the front panel). • turns the display on (if it was turned off for remote operation). • can be used to clear errors. (Press the key once to return to local control, and a second time to clear error message line.) If you have not already pressed the units or Enter key, Cancel exits the currently selected function without changing its value. Esc works the same as it does on a pc keyboard. It: • exits Windows dialogs • clears errors • aborts printing • cancels operations.
12	RF Input	Connector for inputting an external signal. Make sure that the total power of all signals at the analyzer input does **not** exceed +30 dBm (1 watt).
13	Numeric Keypad	Enters a specific numeric value for the current function. Entries appear on the upper left of the display, in the measurement information area.
14	Enter and Arrow Keys	The Enter key terminates data entry when either no unit of measure is needed, or you want to use the default unit. The arrow keys: • Increment and decrement the value of the current measurement selection. • Navigate help topics. • Navigate, or make selections, within Windows dialogs. • Navigate within forms used for setting up measurements. • Navigate within tables. NOTE The arrow keys cannot be used to move a mouse pointer around on the display.
15	Menu/ (Alt) Key	Alt works the same as a pc keyboard. Use it to change control focus in Windows pull-down menus.
16	Ctrl Key	Ctrl works the same as a pc keyboard. Use it to navigate in Windows applications, or to select multiple items in lists.
17	Select / Space Key	Select is also the Space key and it has typical pc functionality. For example, in Windows dialogs, it selects files, checks and unchecks check boxes, and picks radio button choices. It opens a highlighted Help topic.
18	Tab Keys	Use these keys to move between fields in Windows dialogs.
19	Knob	Increments and decrements the value of the current active function.
20	Return Key	Exits the current menu and returns to the previous menu. Has typical pc functionality.

Item		Description
#	**Name**	
21	Full Screen Key	Pressing this key turns off the softkeys to maximize the graticule display area. Press the key again to restore the normal display.
22	Help Key	Initiates a context-sensitive Help display for the current Mode. Once Help is accessed, pressing a front panel key brings up the help topic for that key function.
23	Speaker Control Keys	Enables you to increase or decrease the speaker volume, or mute it.
24	Window Control Keys	These keys select between single or multiple window displays. They zoom the current window to fill the data display, or change the currently selected window. They can be used to switch between the Help window navigation pane and the topic pane.
25	Power Standby/ On	Turns the analyzer on. A green light indicates power on. A yellow light indicates standby mode. NOTE: The front-panel switch is a standby switch, **not** a LINE switch (disconnecting device). The analyzer continues to draw power even when the line switch is in standby. The main power cord can be used as the system disconnecting device. It disconnects the mains circuits from the mains supply.
26	$\overline{Q}$ Input	Input port for the Q channel when in differential mode.[a]
27	Q Input	Input port for the Q channel for either single or differential mode.[a]
28	$\overline{I}$ Input	Input port for the I channel when in differential mode.[a]
29	I Input	Input port for the I channel for either single or differential mode.[a]
30	Cal Out	Output port for calibrating the I, $\overline{I}$, Q and $\overline{Q}$ inputs and probes used with these inputs.[a]

a. Status of the LED indicates whether the current state of the port is active (green) or is not in use (dark).

Overview of key types

The keys labeled **FREQ Channel**, **System**, and **Marker Functions** are all examples of front-panel keys. Most of the dark or light gray keys access menus of functions that are displayed along the right side of the display. These displayed key labels are next to a column of keys called menu keys.

Menu keys list functions based on which front-panel key was pressed last. These functions are also dependant on the current selection of measurement application (**Mode**) and measurement (**Meas**).

If the numeric value of a menu key function can be changed, it is called an active function. The function label of the active function is highlighted after that key has been selected. For example, press **AMPTD Y Scale**. This calls up the menu of related amplitude functions. The function labeled **Ref Level** (the default selected key in the Amplitude menu) is highlighted. **Ref Level** also appears in the upper left of the display in the measurement information area. The displayed value indicates that the function is selected and its value can now be changed using any of the data entry controls.

Some menu keys have multiple choices on their label, such as **On**/**Off** or **Auto**/**Man**. The different choices are selected by pressing the key multiple times. For example, the Auto/Man type of key. To select the function, press the menu key and notice that Auto is underlined and the key becomes highlighted. To change the function to manual, press the key again so that Man is underlined. If there are more than two settings on the key, keep pressing it until the desired selection is underlined.

When a menu first appears, one key label is highlighted to show which key is the default selection. If you press **Marker Function**, the **Marker Function Off** key is the menu default key, and is highlighted.

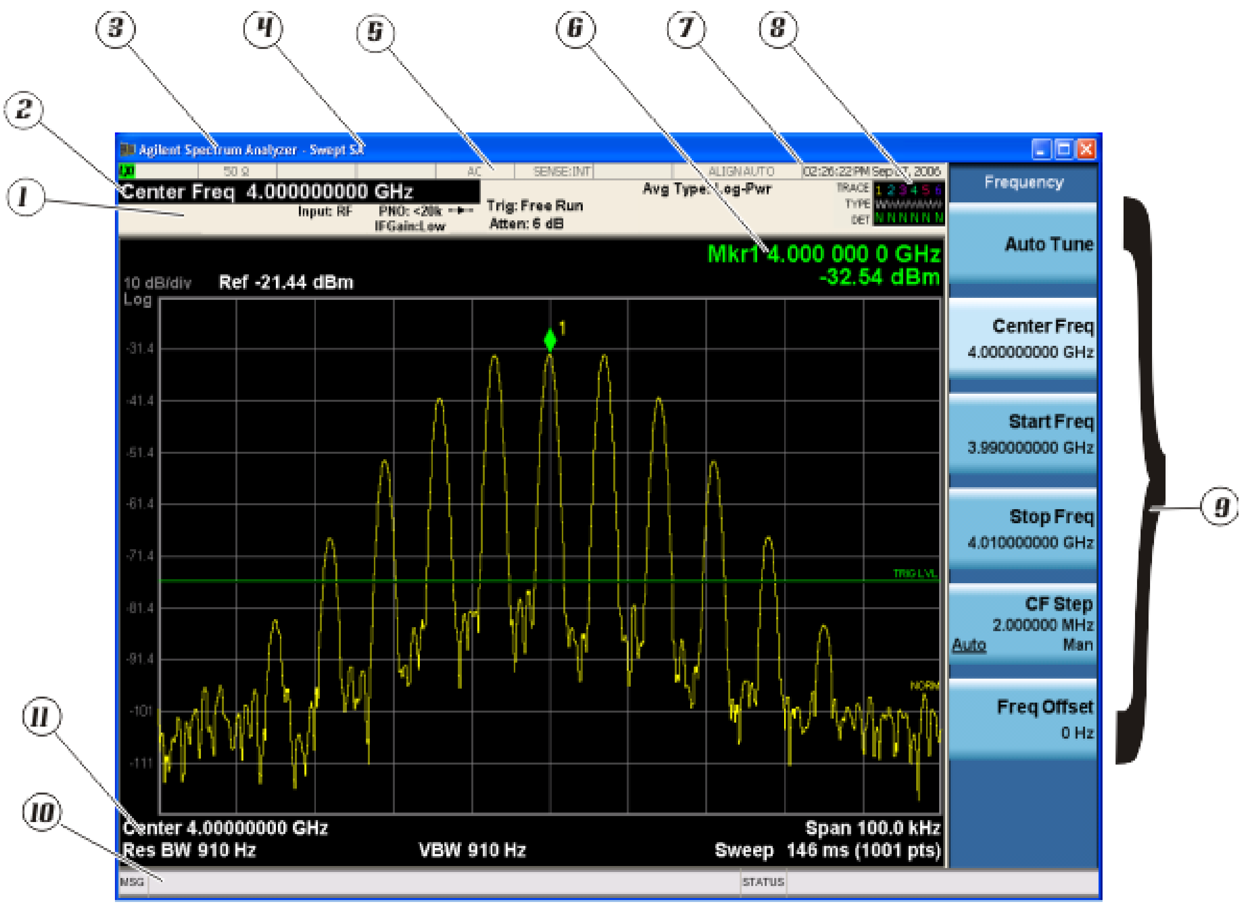
Some of the menu keys are grouped together by a yellow bar running behind the keys near the left side or by a yellow border around the group of keys. When you press a key within the yellow region, such as **Marker Noise**, the highlight moves to that key to show it has been selected. The keys that are linked are related functions, and only one of them can be selected at any one time. For example, a marker can only have one marker function active on it. So if you select a different function it turns off the previous selection. If the current menu is two pages long, the yellow bar or border could include keys on the second page of keys.

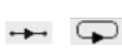
In some key menus, a key label is highlighted to show which key has been selected from multiple available choices. And the menu is immediately exited when you press one of the other keys. For example, when you press the **Select Trace** key (in the **Trace/Detector** menu), it brings up its own menu of keys. The **Trace 1** key is highlighted. When you press the **Trace 2** key, the highlight moves to that key and the screen returns to the **Trace/Detector** menu.

If a displayed key label shows a small solid-black arrow tip pointing to the right, it indicates that additional key menus are available. If the arrow tip is not filled in solid then pressing the key the first time selects that function. Now the arrow is solid and pressing it again brings up an additional menu of settings.

Display Annotations

This section describes the display annotation as it is on the Spectrum Analyzer Measurement Application display. Other measurement application modes have some annotation differences.



Item	Description	Function Keys
1	Measurement bar - Shows general measurement settings and information.  Indicates single/continuous measurement. Some measurements include limits that the data is tested against. A Pass/Fail indication may be shown in the lower left of the measurement bar.	All the keys in the Analyzer Setup part of the front panel.
2	Active Function (measurement bar) - when the current active function has a settable numeric value, it is shown here.	Currently selected front panel key.
3	Banner - shows the name of the selected application that is currently running.	**Mode**
4	Measurement title - shows title information for the current measurement, or a title that you created for the measurement.	**Meas** **View/Display**, **Display**, **Title**

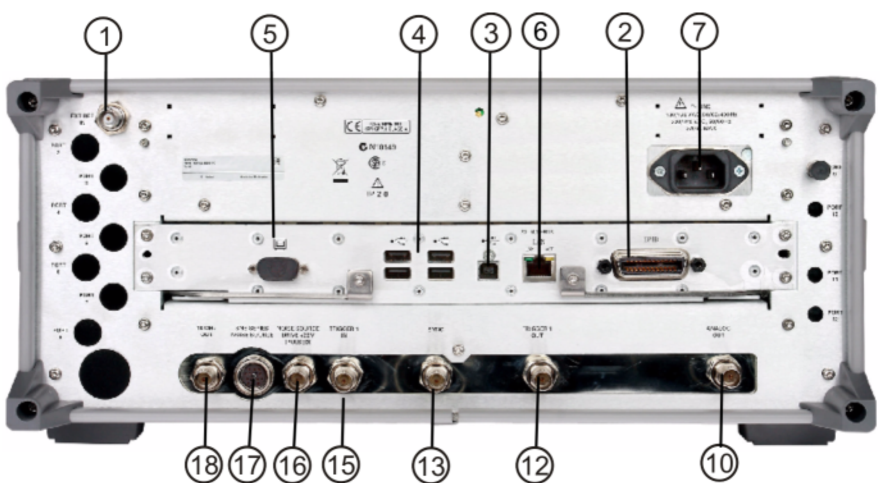
Item	Description	Function Keys
5	Settings panel - displays system information that is not specific to any one application. • Input/Output status - green LXI indicates the LAN is connected. RLTS indicate Remote, Listen, Talk, SRQ • Input impedance and coupling • Selection of external frequency reference • Setting of automatic internal alignment routine	**Local** and **System, I/O Config** **Input/Output**, **Amplitude**, **System** and others
6	Active marker frequency, amplitude or function value	**Marker**
7	Settings panel - time and date display.	**System**, **Control Panel**
8	Trace and detector information	**Trace/Detector**, **Clear Write (W) Trace Average (A) Max Hold (M) Min Hold (m)** **Trace/Detector**, **More, Detector, Average (A) Normal (N) Peak (P) Sample (S) Negative Peak (p)**
9	Key labels that change based on the most recent key press.	Softkeys
10	Displays information, warning and error messages. Message area - single events, Status area - conditions	
11	Measurement settings for the data currently being displayed in the graticule area. In the example above: center frequency, resolution bandwidth, video bandwidth, frequency span, sweep time and number of sweep points.	Keys in the Analyzer Setup part of the front panel.

Rear-Panel Features

MXA and EXA with Option PC2

EXA

CXA

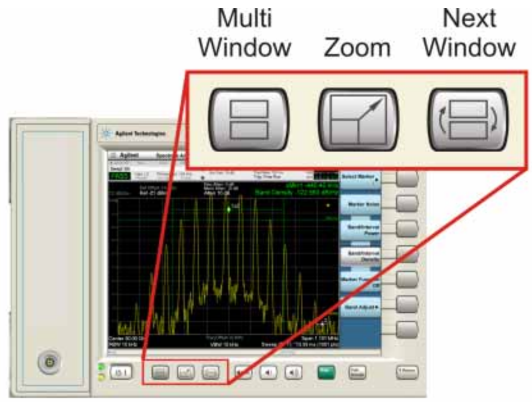


Item #	Item Name	Description
1	EXT REF IN	Input for an external frequency reference signal: For MXA – 1 to 50 MHz For EXA – 10 MHz. For CXA – 10 MHz.
2	GPIB	A General Purpose Interface Bus (GPIB, IEEE 488.1) connection that can be used for remote analyzer operation.
3	USB Connector	USB 2.0 port, Type B. USB TMC (test and measurement class) connects to an external pc controller to control the instrument and for data transfers over a 480 Mbps link.
4	USB Connectors	Standard USB 2.0 ports, Type A. Connect to external peripherals such as a mouse, keyboard, printer, DVD drive, or hard drive.
5	MONITOR	Allows connection of an external VGA monitor.
6	LAN	A TCP/IP Interface that is used for remote analyzer operation.
7	Line power input	The AC power connection. See the product specifications for more details.
8	Removable Disk Drive	Standard on MXA. Optional on EXA.
9	Digital Bus	Reserved for future use.
10	Analog Out	For PXA option YAV: Screen Video Log Video Linear Video Demod Audio
11	TRIGGER 2 OUT	A trigger output used to synchronize other test equipment with the analyzer. Configurable from the Input/Output keys.
12	TRIGGER 1 OUT	A trigger output used to synchronize other test equipment with the analyzer. Configurable from the Input/Output keys.
13	Sync	Reserved for future use.
14	TRIGGER 2 IN	Allows external triggering of measurements.
15	TRIGGER 1 IN	Allows external triggering of measurements.
16	Noise Source Drive +28 V (Pulsed)	For use with Agilent 346A, 346B, and 346C Noise Sources.
17	SNS Series Noise Source	For use with Agilent N4000A, N4001A, N4002A Smart Noise Sources (SNS).

Item		Description
#	Name	
18	10 MHz OUT	An output of the analyzer internal 10 MHz frequency reference signal. It is used to lock the frequency reference of other test equipment to the analyzer.
19	Preselector Tune Out	Reserved for future use.
20	Aux IF Out	For PXA options: CR3 Second IF Out CRP Arbitrary IF Out ALV Log Video

Window Control Keys

The instrument provides three front-panel keys for controlling windows. They are **Multi Window**, **Zoom**, and **Next Window**. These are all “immediate action” keys.



Multi-Window

The **Multi Window** front-panel key is not used at this time. It is there to support future functionality.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Zoom

Zoom is a toggle function. Pressing once Zooms the selected window; pressing again un-zooms.

When Zoom is on for a window, that window will get the entire primary display area. The zoomed window, since it is the selected window, is outlined in green.

Zoom is local to each Measurement. Each Measurement remembers its Zoom state. The Zoom state of each Measurement is part of the Mode’s state.

NOTE Data acquisition and processing for the other windows continues while a window is zoomed, as does all SCPI communication with the other windows.

Remote Command:	`:DISPlay:WINDow:FORMat:ZOOM`
Remote Command:	`:DISPlay:WINDow:FORMat:TILE`
Example:	:DISP:WIND:FORM:ZOOM sets zoomed :DISP:WIND:FORM:TILE sets un-zoomed
Preset:	TILE

Initial S/W Revision:	Prior to A.02.00

Next Window

Selects the next window of the current view.

When this key is selected in Help Mode, it toggles focus between the table of contents window and the topic pane window.

Remote Command:	`:DISPlay:WINDow[:SELect] <number>` `:DISPlay:WINDow[:SELect]?`
Example:	:DISP:WIND 1
Preset:	1
Min:	1
Max:	If <number> is greater than the number of windows, limit to <number of windows>
Initial S/W Revision:	Prior to A.02.00

Selected Window

One and only one window is always selected. The selected window has the focus and all key presses are going to that window.

The selected window has a green boundary. If a window is not selected, its boundary is gray.

If a window in a multi-window display is zoomed it is still outlined in green. If there is only one window, the green outline is not used. This allows the user to distinguish between a zoomed window and a display with only one window.

The selected window is local to each Measurement. Each Measurement remembers which window is selected. The selected window for each Measurement is remembered in Mode state.

Navigating Windows

When the Next Window key is pressed, the next window in the order of precedencebecomes selected. If the selected window was zoomed, the next window will also be zoomed.

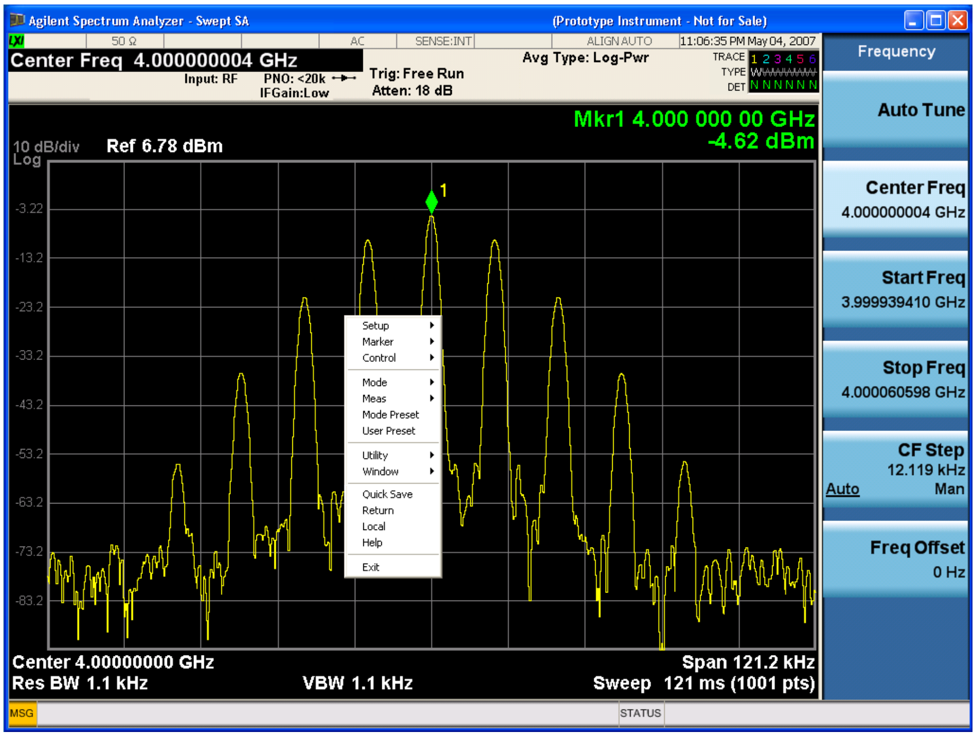
The window navigation does NOT use the arrow and select keys. Those are reserved for navigation within a window.

Mouse and Keyboard Control

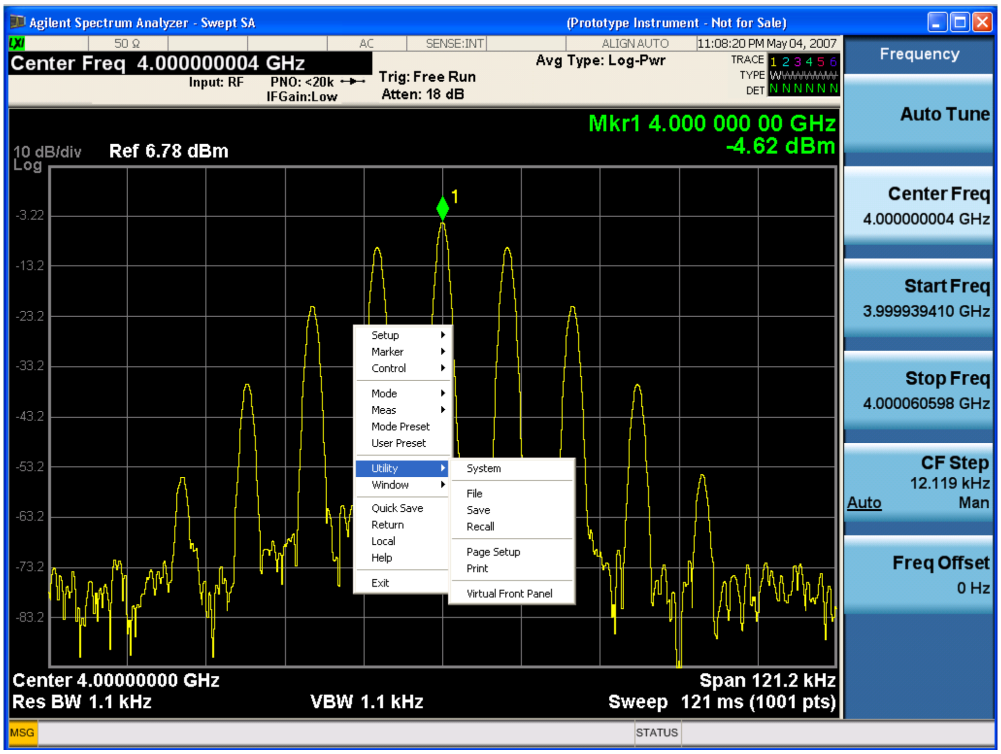
If you do not have access to the instrument front-panel, there are several ways that a mouse and PC Keyboard can give you access to functions normally accessed using the front-panel keys.

Right-Click

If you plug in a mouse and right-click on the analyzer screen, a menu will appear as below:

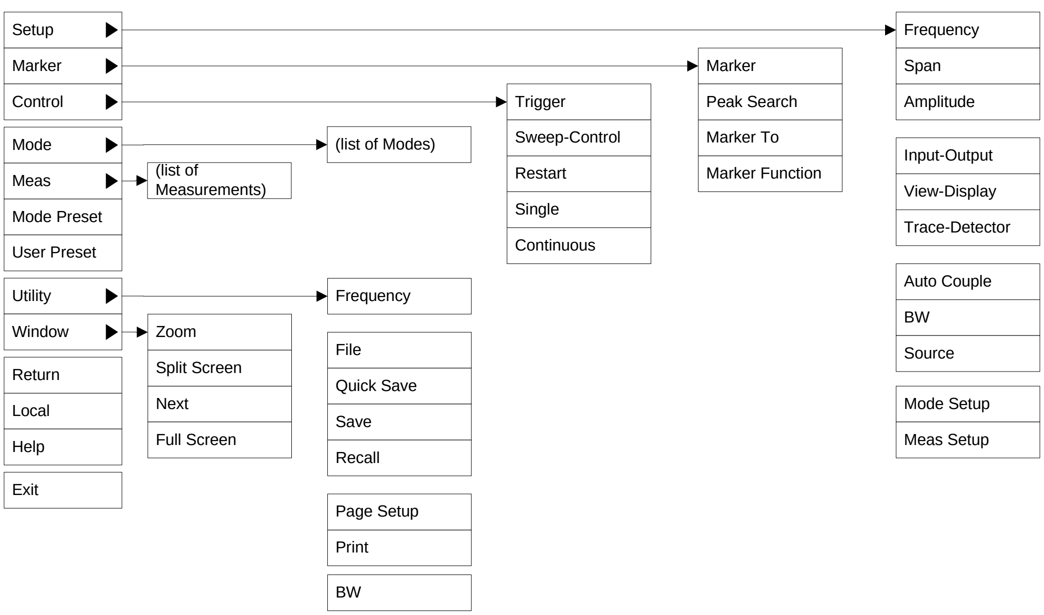


Placing the mouse on one of the rows marked with a right arrow symbol will cause that row to expand, as for example below where the mouse is hovered over the “Utility” row:



This method can be used to access any of the front-panel keys by using a mouse; as for example if you are accessing the instrument through Remote Desktop.

The array of keys thus available is shown below:



PC Keyboard

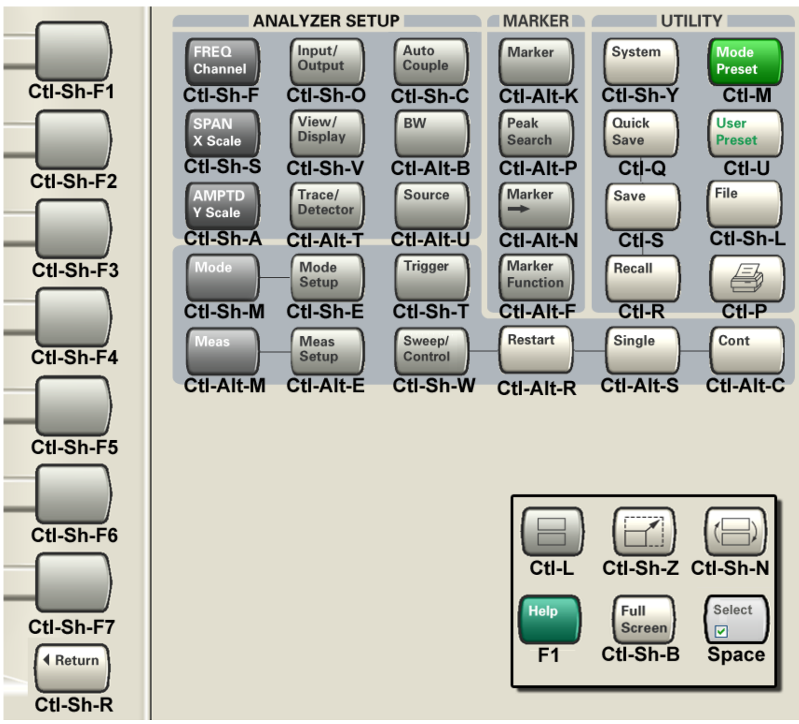
If you have a PC keyboard plugged in (or via Remote Desktop), certain key codes on the PC keyboard map to front-panel keys on the GPSA front panel. These key codes are shown below:

Front-panel key	Key code
Frequency	CTRL+SHIFT+F
Span	CTRL+SHIFT+S
Amplitude	CTRL+SHIFT+A
Input/Output	CTRL+SHIFT+O
View/Display	CTRL+SHIFT+V
Trace/Detector	CTRL+ALT+T
Auto Couple	CTRL+SHIFT+C
Bandwidth	CTRL+ALT+B
Source	CTRL+SHIFT+E
Marker	CTRL+ALT+K
Peak Search	CTRL+ALT+P
Marker To	CTRL+ALT+N
Marker Function	CTRL+ALT+F
System	CTRL+SHIFT+Y
Quick Save	CTRL+Q
Save	CTRL+S
Recall	CTRL+R
Mode Preset	CTRL+M
User Preset	CTRL+U
Print	CTRL+P
File	CTRL+SHIFT+L
Mode	CTRL+SHIFT+M
Measure	CTRL+ALT+M
Mode Setup	CTRL+SHIFT+E
Meas Setup	CTRL+ALT+E
Trigger	CTRL+SHIFT+T
Sweep/Control	CTRL+SHIFT+W
Restart	CTRL+ALT+R
Single	CTRL+ALT+S

Cont	CTRL+ALT+C
Zoom	CTRL+SHIFT+Z
Next Window	CTRL+SHIFT+N
Split Screen	CTRL+L
Full Screen	CTRL+SHIFT+B
Return	CTRL+SHIFT+R
Mute	Mute
Inc Audio	Volume Up
Dec Audio	Volume Down
Help	F1
Control	CTRL
Alt	ALT
Enter	Return
Cancel	Esc
Del	Delete
Backspace	Backspace
Select	Space
Up Arrow	Up
Down Arrow	Down
Left Arrow	Left
Right Arrow	Right
Menu key 1	CTRL+SHIFT+F1
Menu key 2	CTRL+SHIFT+F2
Menu key 3	CTRL+SHIFT+F3
Menu key 4	CTRL+SHIFT+F4
Menu key 5	CTRL+SHIFT+F5
Menu key 6	CTRL+SHIFT+F6
Menu key 7	CTRL+SHIFT+F7
Backspace	BACKSPACE
Enter	ENTER
Tab	Tab
1	1

2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

Here is a pictorial view of the table:



Instrument Security & Memory Volatility

If you are using the instrument in a secure environment, you may need details of how to clear or sanitize its memory, in compliance with published security standards of the United States Department of Defense, or other similar authorities.

For the X Series analyzers, this information is contained in the document "Security Features and Volatility". This document is **not** included in the Documentation CD, or the instrument's on-disk library, but it may be downloaded from Agilent's web site.

To obtain a copy of the document, click on or browse to the following URL:

http://www.agilent.com/find/security

To locate and download the document, select Model Number "N9020A", then click "Submit". Then, follow the on-screen instructions to download the file.

4 About the Agilent 89601X VXA Signal Analyzer Measurement

This chapter provides overall information on the Agilent 89601X VXA Signal Analyzer Measurement Application and describes the measurements made by the analyzer. Installation instructions for adding this option to your analyzer are provided in this section, in case you purchased this option separately.

What Does the Agilent 89601X VXA Signal Analyzer Measurement Application Do?

The 89601X VXA is a full-featured vector signal analyzer that can help determine if an RF modulated source or transmitter is working correctly. There are standard and optional measurements for complete analysis and demodulation of most communications signals.

The Vector Analysis measurement (included in Option 205) provides:

- Spectrum analysis and Time Domain analysis with Signal Tracking
- Band Power, Occupied Bandwidth, and ACP measurements
- Markers, Marker Coupling, Triggering
- Time Gating
- Frequency Counter

The Analog Demodulation measurement (included in Option 205) will perform all the above and will also analyze and demodulate signals that use the following modulation formats:

- AM, FM, PM

The Digital Demodulation measurement (Option AYA) will analyze and demodulate signals that use the following modulation formats:

- MSK
- QPSK
- 8PSK
- BPSK
- π/4 DQPSK
- DQPSK
- π/8 D8PSK
- D8PSK
- Offset QPSK
- QAM16, 32, 64, 128, 256, 512, 1024
- DVB QAM 16, 32, 64, 128, 256
- FSK 2, 4, 8, 16 states
- VSB8, VSB16
- APSK16, 32, 16 w/dub, 32 w/dub

- Standard communications formats provided by Option AYA include:
  - Cellular: IS–95 Base and Mobile, GSM, EDGE, CDPD, NADC, PDC, PHP, 3GPP (W-CDMA)
  - Wireless Networking: 802.11b, HIPERLAN/1 (HBR and LBR), Bluetooth, ZigBee 868, 915, and 2450
  - Digital Video: DTV8, DTV16, DVB16, DVB32, DVB64, DVB128, DVB256, DVB 16APSK with code rates 2/3 to 9/10, DVB 32 APSK with code rates 3/4 to 9/10.
  - Other: APCO 25, DECT, TETRA, VDL Mode 3

With other digital demod options, the 89601X VXA will also demodulate more complicated signals that conform to the following standard communications formats:

- Option B7R - WLAN 802.11 a/b/g, OFDM and DSSS
- Option H09 - iDEN, WiDEN, and MotoTalk

NOTE For CDMA signals, 89601X VXA can analyze digital modulation for a single code channel only. If multiple code channels are transmitted, synchronization will fail, and incorrect EVM results will be obtained. For modulation quality measurements of multiple code channels, Modulation Accuracy and Code Domain measurements must be performed by a full-featured standard-based measurement application, like N9073for W-CDMA.

Installing Application Software

When you want to install a measurement application after your initial hardware purchase, you actually only need to license it. All of the available applications are loaded in your analyzer at the time of purchase.

So when you purchase an application, you will receive an entitlement certificate that is used to obtain a license key for that particular measurement application. Enter the license key that you obtain into the N9020A Signal Analyzer to activate the new measurement application. See below for more information.

For the latest information on Agilent Signal Analyzer measurement applications and upgrade kits, visit the following internet URL.

http://www.agilent.com/find/sa_upgrades

Viewing a License Key

Measurement personalities purchased with your instrument have been installed and activated at the factory before shipment. The instrument requires a unique **License Key** for every measurement application purchased. The license key is a hexadecimal string that is specific to your measurement application, instrument model number and serial number. It enables you to install, or reactivate that particular application.

Press **System**, **Show**, **System** to display which measurement applications are currently licensed in your analyzer.

Go to the following location to view the license keys for the installed measurement applications:

C:\Programing Files\Agilent\Licensing

NOTE You may want to keep a copy of your license key in a secure location. You can print out a copy of the display showing the license numbers to do this. If you should lose your license key, call your nearest Agilent Technologies service or sales office for assistance.

Obtaining and Installing a License Key

If you purchase an additional application that requires installation, you will receive an “Entitlement Certificate” which may be redeemed for a license key for one instrument. Follow the instructions that accompany the certificate to obtain your license key.

Installing a license key for the selected application can be done automatically using a USB memory device. To do this, you would put the license file on the USB memory device at the root level. Follow the instructions that come with your software installation kit.

Installing a license key can also be done manually using the license management application in the instrument. It is found through the instrument front panel keys at **System**, **Licensing. . .** , or internally at C:\Programming Files\Agilent\Licensing.

NOTE	You can also use these procedures to reinstall a license key that has been accidentally deleted, or lost due to a memory failure.

Missing and Old Measurement Application Software

All the software applications were loaded at the time of original instrument manufacture. It is a good idea to regularly update your software with the latest available version. This assures that you get any improvements and expanded functionality that is available.

Because the software was loaded at the initial purchase, there may be additional measurement applications that are now available. If the application you are interested in licensing is not available, you will need to do a software update. (Press **System**, **Show**, **System**.)

Check the Agilent internet website for the latest software versions available for downloading:

http://www.agilent.com/find/mxa_software
http://www.agilent.com/find/exa_software

You must load the updated software package into the analyzer from a USB drive, or directly from the internet. An automatic loading program is included with the files.

5 System Functions

File

Opens a menu that enables you to access various standard and custom Windows functions. Press any other front-panel key to exit

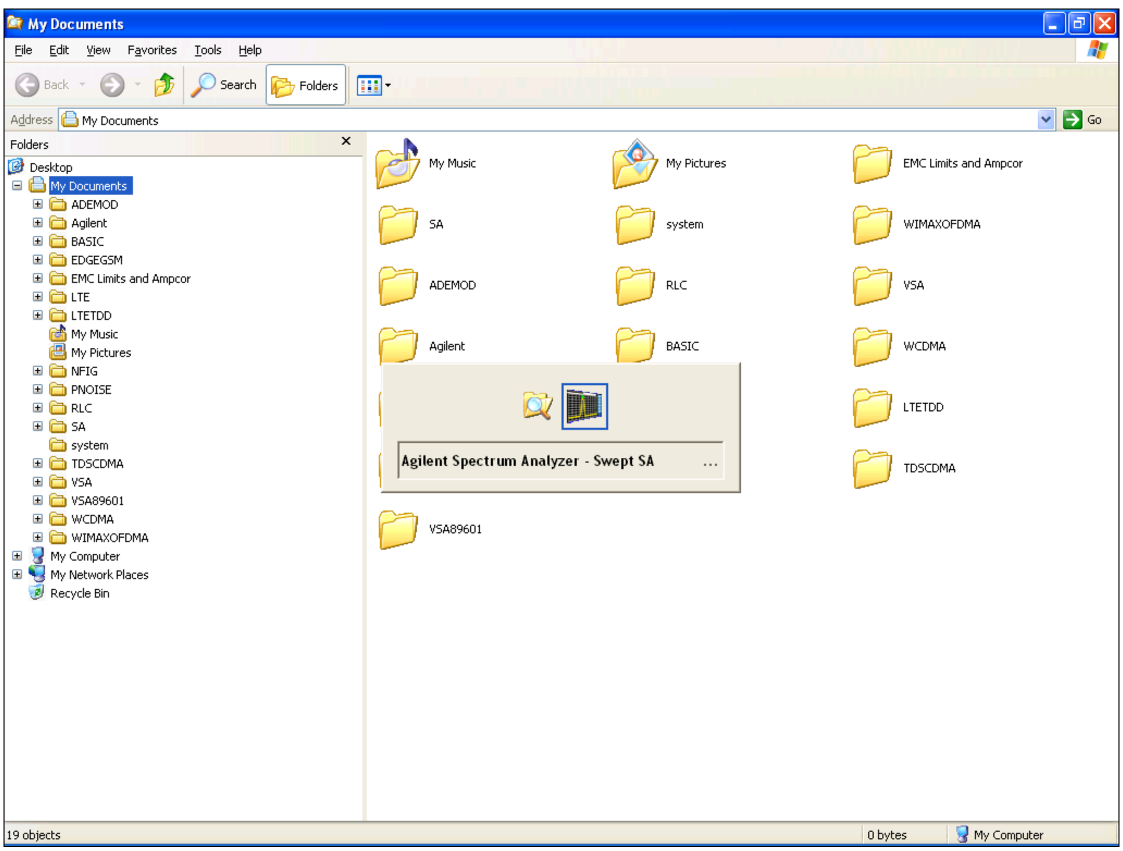
Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

File Explorer

Opens the standard Windows File Explorer. The File Explorer opensin the My Documents directory for the current user.

The File Explorer is a separate Windows application, so to return to the analyzer once you are in the File Explorer, you may either:

Exit the File Explorer by clicking on the red X in the upper right hand corner, with a mouse



Or use Alt-Tab: press and hold the Alt 

key and press and release the Tab key until the Analyzer logo is showing in the window in the center of the screen, as above, then release the Alt key.

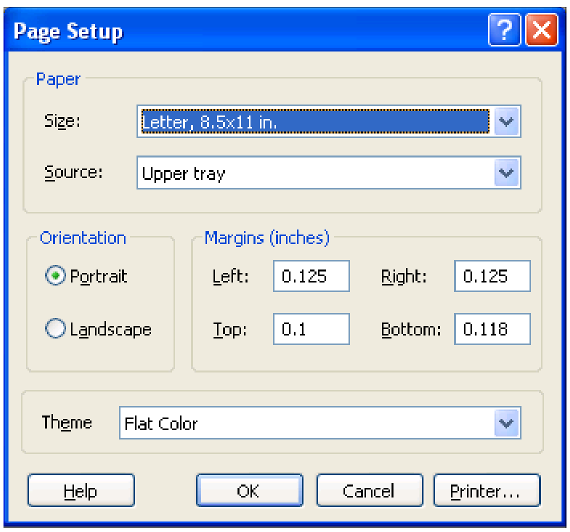
Key Path	**File**
Initial S/W Revision	Prior to A.02.00

Page Setup

The Page Setup key brings up a Windows Page Setup dialog that allows you to control aspects of the pages sent to the printer when the PRINT hardkey is pressed.

Key Path	**File**
Initial S/W Revision	Prior to A.02.00

Paper size, the printer paper source, the page orientation and the margins are all settable. Just like any standard Windows dialog, you may navigate the dialog using front-panel keys, or a mouse. There are no SCPI commands for controlling these parameters.



Also contained in this dialog is a drop-down control that lets you select the Theme to use when printing. For more on Themes, see information under View/Display, Display, System Display Settings, Theme. The Theme control has a corresponding SCPI command:

Parameter Name	Print Themes
Parameter Type	Enum
Mode	All
Remote Command	`:SYSTem:PRINt:THEMe TDColor|TDMonochrome|FCOLor|FMONochrome` `:SYSTem:PRINt:THEMe?`
Example	:SYST:PRIN:THEM FCOL

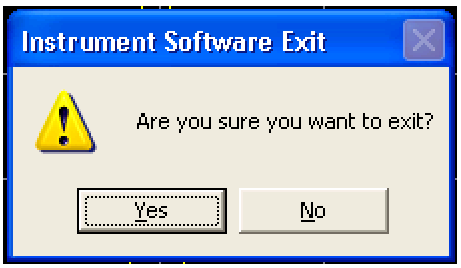
Setup	:SYSTem:DEFault MISC
Preset	FCOL; not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the modes.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Print

Refer to your Microsoft Windows Operating System manual.

Exit

This key, when pressed, will exit the Instrument Application. A dialog box is used to confirm that you intended to exit the application:



Key Path	**File**
Mode	All
Notes	The Instrument Application will close. No further SCPI commands can be sent. Use with caution!
Initial S/W Revision	Prior to A.02.00

Preset

Mode Preset

Returns the active mode to a known state.

Mode Preset does the following for the currently active mode:

- Aborts the currently running measurement.
- Brings up the default menu for the mode, with no active function.
- Sets measurement settings to their preset values for the active mode only.
- Activates the default measurement.
- Brings up the default menu for the mode.
- Clears the input and output buffers.
- Sets Status Byte to 0.

Mode Preset does not:

Cause a mode switch

Affect mode persistent settings

Affect system settings

Key Path	**Front-panel key**
Remote Command	`:SYSTem:PRESet`
Example	:SYST:PRES
Notes	*RST is preferred over :SYST:PRES for remote operation. *RST does a Mode Preset, as done by the :SYST:PRES command, and sets the measurement mode to Single measurement rather than Continuous for optimal remote control throughput. Clears all pending OPC bits. The Status Byte is set to 0.
Couplings	A Mode Preset aborts the currently running measurement, activates the default measurement, and. gets the mode to a consistent state with all of the default couplings set.
Initial S/W Revision	Prior to A.02.00

How-To Preset

The table below shows all possible presets, their corresponding SCPI commands and front-panel access (key paths). Instrument settings depend on the current measurement context. Some settings are local to the current measurement, some are global (common) across all the measurements in the current mode, and some are global to all the available modes. In a similar way, restoring the settings to their preset state can be done within the different contexts.

Auto Couple - is a measurement local key. It sets all Auto/Man parameter couplings in the measurement to Auto. Any Auto/Man selection that is local to other measurements in the mode will not be affected.

Meas Preset - is a measurement local key. Meas Preset resets all the variables local to the current measurement except the persistent ones.

Mode Preset - resets all the current mode's measurement local and measurement global variables except the persistent ones.

Restore Mode Defaults - resets ALL the Mode variables (and all the Meas global and Meas local variables), including the persistent ones.

Type Of Preset	SCPI Command	Front Panel Access
Auto Couple	:COUPle ALL	Auto Couple front-panel key
Meas Preset	:CONFigure:<Measurement>	Meas Setup Menu
Mode Preset	:SYSTem:PRESet	Mode Preset (green key)
Restore Mode Defaults	:INSTrument:DEFault	Mode Setup Menu
Restore All Mode Defaults	:SYSTem:DEFault MODes	System Menu; Restore System Default Menu
*RST	*RST	not possible (Mode Preset with Single)
Restore Input/Output Defaults	:SYSTem:DEFault INPut	System Menu; Restore System Default Menu
Restore Power On Defaults	:SYSTem:DEFault PON	System Menu; Restore System Default Menu
Restore Alignment Defaults	:SYSTem:DEFault ALIGn	System Menu; Restore System Default Menu
Restore Miscellaneous Defaults	:SYSTem:DEFault MISC	System Menu; Restore System Default Menu
Restore All System Defaults	:SYSTem:DEFault [ALL] :SYSTem:PRESet:PERSistent	System Menu; Restore System Default Menu
User Preset	:SYSTem:PRESet:USER	User Preset Menu
User Preset All Modes	:SYSTem:PRESet:USER:ALL	User Preset Menu
Power On Mode Preset	:SYSTem:PON:TYPE MODE	System Menu
Power On User Preset	:SYSTem:PON:TYPE USER	System Menu
Power On Last State	:SYSTem:PON:TYPE LAST	System Menu

Restore Mode Defaults

Resets the state for the currently active mode by resetting the mode persistent settings to their factory default values, clearing mode data and by performing a Mode Preset. This function will never cause a mode switch. This function performs a full preset for the currently active mode; whereas, Mode Preset performs a partial preset. Restore Mode Defaults does not affect any system settings. System settings are reset by the Restore System Defaults function. This function does reset mode data; as well as settings.

Key Path	**Mode Setup**
Remote Command	`:INSTrument:DEFault`
Example	:INST:DEF
Notes	Clears all pending OPC bits. The Status Byte is set to 0. A message comes up saying: “If you are sure, press key again”.
Couplings	A Restore Mode Defaults will cause the currently running measurement to be aborted and causes the default measurement to be active. It gets the mode to a consistent state with all of the default couplings set.
Initial S/W Revision	Prior to A.02.00

*RST (Remote Command Only)

*RST is equivalent to :SYST:PRES;:INIT:CONT OFF which is a Mode Preset in the Single measurement state. This remote command is preferred over Mode Preset remote command - :SYST:PRES, as optimal remote programming occurs with the instrument in the single measurement state.

Remote Command:	`*RST`
Example:	*RST
Notes:	Sequential Clears all pending OPC bits and the Status Byte is set to 0.
Couplings:	A *RST will cause the currently running measurement to be aborted and cause the default measurement to be active. *RST gets the mode to a consistent state with all of the default couplings set.
Initial S/W Revision:	Prior to A.02.00

Print

This front-panel key is equivalent to performing a File, Print, OK. It immediately performs the currently configured Print to the Default printer.

The :HCOPy command is equivalent to pressing the PRINT key. The HCOPy:ABORt command can be used to abort a print which is already in progress. Sending HCOPy:ABORt will cause the analyzer to stop sending data to the printer, although the printer may continue or even complete the print, depending on how much data was sent to the printer before the user sent the ABORt command.

Key Path	**Front-panel key**
Remote Command	`:HCOPy[:IMMediate]`
Initial S/W Revision	Prior to A.02.00

Key Path	**SCPI command only**
Remote Command	`:HCOPy:ABORt`
Initial S/W Revision	Prior to A.02.00

Quick Save

The Quick Save front-panel key repeats the most recent save that was performed from the Save menu, with the following exceptions: :

Register saves are not remembered as Saves for the purpose of the Quick Save function

If the current measurement does not support the last non-register save that was performed, an informational message is generated, "File type not supported for this measurement"

Quick Save repeats the last type of qualified save (that is, a save qualified by the above criteria) in the last save directory by creating a unique filename using the Auto File Naming algorithm described below.

If Quick Save is pressed after startup and before any qualified Save has been performed, the Quick Save performs a Screen Image save using the current settings for Screen Image saves (current theme, current directory), which then becomes the "last save" for the purpose of subsequent Quick Saves.

The Auto File Naming feature automatically generates a file name for use when saving a file. The filename consists of a prefix and suffix separated by a dot, as is standard for the Windows® file system. A default prefix exists for each of the available file types:

Type	Default Prefix	Menu
State	State_	(Save/Recall)
Trace + State	State_	(Save/Recall)
Screen	Screen_	(Save/Recall)
Amplitude Corrections	Ampcor_	(Import/Export)
Traces	Trace_	(Import/Export)
Limit Lines	LLine_	(Import/Export)
Measurement Result	MeasR_	(Import/Export)
Capture Buffer	CapBuf_	(Import/Export)

A four digit number is appended to the prefix to create a unique file name. The numbering sequence starts at 0000 within each Mode for each file type and works its way up to 9999, then wraps to 0000 again. It remembers where it was through a Mode Preset and when leaving and returning to the Mode. It is reset by Restore Misc Defaults and Restore System Defaults and subsequent running of the instrument application. So, for example, the first auto file name generated for State files is State_0000.state. The next is State_0001, and so forth.

One of the key features of Auto File Name is that we guarantee that the Auto File Name will never conflict with an existing file. The algorithm looks for the next available number. If it gets to 9999, then it looks for holes. If it find no holes, that is no more numbers are available, it gives an error.

For example, if when we get to State_0010.state there is already a State_0010.state file in the current directory, it advances the counter to State_0011.state to ensure that no conflict will exist (and then it verifies that State_0011.state also does not exist in the current directory and advances again if it does, and so forth).

If you enter a file name for a given file type, then the prefix becomes the filename you entered instead of the default prefix, followed by an underscore. The last four letters (the suffix) are the 4-digit number.

For example, if you save a measurement results file as “fred.csv”, then the next auto file name chosen for a measurement results save will be fred_0000.csv.

NOTE Although 0000 is used in the example above, the number that is used is actually the current number in the Meas Results sequence, that is, the number that would have been used if you had not entered your own file name.

.

NOTE If the filename you entered ends with _dddd, where d=any number, making it look just like an auto file name, then the next auto file name picks up where you left off with the suffix being dddd + 1.

Key Path	**Front-panel key**
Notes	No remote command for this key specifically.
Initial S/W Revision	Prior to A.02.00

Recall

Accesses a menu that enables you to select the information that you want to recall.

The options are State, Trace and Data. (screen images can be saved, but not recalled.) The default paths for Recall are data type dependent and are the same as for the Save key.

Key Path	**Front-panel key**
Notes	No remote command directly controls the Recall Type that this key controls. The Recall type is a node in the :MMEM:LOAD command. An example is :MMEM:LOAD:STATe <filename>.
Initial S/W Revision	Prior to A.02.00

State

Accesses a menu that enables you to recall a State that has previously been saved. Recalling a saved state returns the analyzer as close as possible to the mode context and may cause a mode switch if the file selected is not for the current active mode. A State file can be recalled from either a register or a file. Once you select the source of the recall in the State menu, the recall will occur.

Key Path	**Recall**
Mode	All
Example	MMEM:LOAD:STAT "MyStateFile.state" This loads the state file data (on the default file directory path) into the instrument state.
Notes	See “Open” on page 141.
Initial S/W Revision	Prior to A.02.00

In measurements that support saving Traces, for example, Swept SA, the Trace data is saved along with the State in the State file. When recalling the State, the Trace data is recalled as well. Traces are recalled exactly as they were stored, including the writing mode and update and display modes. If a Trace was updating and visible when the State was saved, it will come back updating and visible,and its data will be rewritten right away. When you use State to save and recall traces, any trace whose data must be preserved should be placed in View or Blank mode before saving.

The following table describes the Trace Save and Recall possibilities:

You want to recall state and one trace’s data, leaving other traces unaffected.	Save Trace+State from 1 trace. Make sure that no other traces are updating (they should all be in View or Blank mode) when the save is performed.	On Recall, specify the trace you want to load the one trace’s data into. This trace will load in View. All other traces’ data will be unaffected, although their trace mode will be as it was when the state save was performed.

You want to recall all traces	Save Trace+State from ALL traces.	On Recall, all traces will come back in View (or Blank if they were in Blank or Background when saved)
You want all traces to load exactly as they were when saved.	Save State	On recall, all traces' mode and data will be exactly as they were when saved. Any traces that were updating will have their data immediately overwritten.

Register 1 thru Register 6

Selecting any one of these register keys causes the State of the mode from the specified Register to be recalled. Each of the register keys annotates whether it is empty or at what date and time it was last modified.

Registers are shared by all modes, so recalling from any one of the 6 registers may cause a mode switch to the mode that was active when the save to the Register occurred.

After the recall completes, the message "Register <register number> recalled" appears in the message bar.

Key Path	**Recall, State**
Example	*RCL 1
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, State**
Example	*RCL 2
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, State**
Example	*RCL 3
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, State**
Example	*RCL 4

Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, State**
Example	*RCL 5
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, State**
Example	*RCL 6
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

From File\ File Open

Brings up the standard Windows® File Open dialog and its corresponding key menu.

When you first enter this dialog, the State File default path is in the Look In: box in this File Open dialog. The File Open dialog is loaded with the file information related to the State Save Type. The first *.state file is highlighted. The only files that are visible are the *.state files and the Files of type is *.state, since .state is the file suffix for the State save type. For more details, refer to “Open” on page 151.

Key Path	**Recall, State**
Notes	Brings up the Open dialog for recalling a State Save Type
Initial S/W Revision	Prior to A.02.00

Open

The recalling State function must first verify the file is recallable in the current instrument by checking the software version and model number of the instrument. If everything matches, a full recall proceeds by aborting the currently running measurement, and then loading the State from the saved state file to as close as possible to the context in which the save occurred. You can open state files from any mode, so recalling a State file switches to the mode that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file. The saved measurement of the mode becomes the newly active measurement and the data relevant to the measurement (if there is any) is recalled.

If there is a mismatch between file version or model number or instrument version or model number, the recall function tries to recall as much as possible and it returns a warning message of what it did.

NOTE No Trace data is loaded when recalling a State File. Measurements that support loading of trace data will include a Trace key in the Recall menu and will load State + Trace data from .trace files under that key.

Key Path	**Recall, State, From File…**
Remote Command	`:MMEMory:LOAD:STATe <filename>`
Example	:MMEM:LOAD:STAT "myState.state" recalls the file myState.state on the default path
Notes	Auto return to the State menu and the Open dialog goes away. Advisory Event "Recalled File <file name>" after recall is complete.
Notes	If the file specified is empty an error is generated. If the specified file does not exist, another error is generated. If there is a mismatch between the file and the proper file type, an error is generated. If there is a mismatch between file version or model number or instrument version or model number, a warning is displayed. Then it returns to the State menu and File Open dialog goes away. Although the trace data is included in the .state file it is not recalled. Recalling trace data is left for .trace files only for measurements that support recalling of trace data. Errors are generated if the specified file is empty or does not exist, or there is a file type mismatch.
Initial S/W Revision	Prior to A.02.00

The state of a mode includes all of the variables affected by doing a full preset. It not only recalls Mode Preset settings, but it also recalls all of the mode persistent settings and data if the mode has either. Each mode determines whether data is part of mode state and if the mode has any persistent settings. **Recall State** also recalls all of the **Input/Output** system settings, since they are saved with each State File for each mode.

The Recall State function does the following:

Verifies that the file is recallable on this instrument using the version number and model number.

Aborts the currently running measurement.

Clears any pending operations.

Switches to the mode of the selected Save State file.

Sets mode State and Input/Output system settings to the values in the selected Saved State file.

Limits settings that differ based on model number, licensing or version number.

Makes the saved measurement for the mode the active measurement.

Clears the input and output buffers.

Status Byte is set to 0.

Executes a *CLS

Trace (+State)

Select Trace as the data type to be recalled. Trace files include the state of the mode they were saved from as well as the trace data, with internal flags to indicate which trace the user was trying to save, which may include ALL traces. They are otherwise identical to State files. Recalling **trace data** may cause a mode switch if the file selected is not for the currently active mode.

Not all modes support saving of trace data with the state, and for modes that do, not all measurements do. The Trace key is grayed out for measurements that do not support trace recall. It is blanked for modes that do not support trace recall.

This key will not actually cause the recall, since the recall feature still needs to know from which file to recall the trace and which trace to recall it into. Pressing this key will bring up the Recall Trace menu that provides you with the options of where to retrieve the trace.

For quick recalls, the Trace menu lists 5 registers to recall from or you can select a file to recall from.

Key Path	**Recall**
Mode	SA
Example	MMEM:LOAD:TRAC TRACE2,"MyTraceFile.trace" This loads the trace file data (on the default file directory path) into the specified trace. :MMEM:LOAD:TRAC:REG TRACE1,2 restores the trace data in register 2 to Trace 1
Initial S/W Revision	Prior to A.02.00

Register 1 thru Register 5

Selecting any one of these register keys causes the Traces and State from the specified Register to be recalled. Each of the register keys annotates whether it is empty or at what date and time it was last modified.

Trace registers are shared by all modes, so recalling from any one of the 5 registers may cause a mode switch to the mode that was active when the save to the Register occurred.

After the recall completes, the message “Trace Register <register number> recalled” appears in the message bar.

Key Path	**Recall, Trace**
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, Trace**
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.

Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, Trace**
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, Trace**
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Recall, Trace**
Readback	Date and time with seconds resolution of the last Save is displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

To Trace

These menu selections let you pick which Trace to recall the saved trace into. Not all modes have the full 6 traces available. The default is the currently selected trace, selected in this menu or in the Trace/Detector, Export Data, Import Data, or Save Trace menus, except if you have chosen All, then it remains chosen until you specifically change it to a single trace.

If the .trace file is an "all trace" file, "**To Trace**" is ignored and the traces each go back to the trace they were saved from.

Once selected, the key returns back to the Recall Trace menu and the selected Trace number is annotated on the key. Now you have selected exactly where the trace needs to be recalled. To trigger a recall of the selected Trace, you must select the **Open** key in the Recall Trace menu.

Key Path	**Save, Data, Trace**
Mode	SA
Initial S/W Revision	Prior to A.02.00

Open…

Accesses the standard Windows File Open dialog and its corresponding File Open menu. When you navigate to this selection, you have already determinedyou are recalling Trace and now you want to specify from which file to do the recall.

When you first enter this dialog, the State File default path is in the Look In: box. The **File Open** dialog is loaded with the file information related to the State Save Type. The first *.trace file is highlighted. Also, the only files that are visible are the *.trace files and the Files of type is *.trace, since .trace is the file suffix for the Trace save type. For more details, refer to "File Open Dialog and Menu" on page 150.

Key Path	**Recall, Trace**
Mode	SA
Notes	Brings up Open dialog for recalling a Trace Save Type
Initial S/W Revision	Prior to A.02.00

Open

The recalling Trace function must first verify the file is recallable in this instrument by checking instrument software version and model number, since it includes State. If everything matches, a full recall proceeds by aborting the currently running measurement, and loading the state from the saved state file to as close as possible to the context in which the save occurred. You can open .trace files from any mode that supports them, so recalling a Trace file switches to the mode that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file and the saved measurement of the mode becomes the newly active measurement, and the data relevant to the measurement (if there is any) is recalled.

Once the state is loaded, the trace data must be loaded. The internal flags are consulted to see which trace to load and the "To Trace" setting to see where to load it. Trace data is always loaded with the specified trace set to View, so that the data is visible and not updating(so as not to erase the recalled data). If the file is an "all trace" file, all traces are loaded with the saved data(to the original trace the data was saved from) and set to View. Traces whose data is not loaded are restored to the update state that existed when they were saved.

In every other way a Trace load is identical to a State load. See section "File Open Dialog and Menu" on page 150 for details.

Key Path	**Recall, Trace, Open…**
Remote Command	`:MMEMory:LOAD:TRACe TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,<filename>` `:MMEMory:LOAD:TRACe:REGister TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,<integer>`
Example	:MMEM:LOAD:TRAC TRACE2,"myState.trace" recalls the file myState.trace on the default path; if it is a "single trace" save file, that trace is loaded to trace 2, andis set to be not updating. :MMEM:LOAD:TRAC:REG TRACE1,2 restores the trace data in register 2 to Trace 1

Notes	Auto return to the Trace menu and the Open dialog goes away. Advisory Event "Recalled File <file name>" after recall is complete. Some modes and measurements do not have available all 6 traces. Phase Noise mode command, for example, is: MMEMory:LOAD:TRACe TRACE1|TRACE2|TRACE3,<filename> The load trace command actually performs a load state, which in the Swept SA measurement includes the trace data. However it looks in the recalled state file to see how it was flagged at save time. The possibilities are: If the trace file was saved using one of the TRACE# enums, it is flagged as a single trace save file. The trace that was flagged as the one that was saved, is loaded to the trace specified. The trace is loaded with update off and display on, and none of the other traces are loaded. If the trace file was saved using one the ALL enum, it is flagged as an "all traces" file. And all traces will be loaded. All of the traces are loaded with Update=Off to keep them from updating, regardless of the setting of "Recall State w/Trace Update".
Initial S/W Revision	Prior to A.02.00

Data (Import)

Importing a data file loads data that was previously saved from the current measurement or from other measurements and/or modes that produce the same type of data. The Import Menu only contains Data Types that are supported by the current measurement.

Since the commonly exported data files are in .csv format, the data can be edited by the user prior to importing. This allows you to export a data file, manipulate the data in Excel (the most common PC Application for manipulating .csv files) and then import it.

Importing Data loads measurement data from the specified file into the specified or default destination, depending on the data type selected. Selecting an Import Data menu key will not actually cause the importing to occur, since the analyzer still needs to know from where to get the data. Pressing the Open key in this menu brings up the Open dialog and Open menu that provides you with the options from where to recall the data. Once a filename has been selected or entered in the Open menu, the recall occurs as soon as the Open key is pressed.

Key Path	**Recall**
Mode	All
Notes	The menu is built from whatever data types are available for the mode. Some keys will be missing completely, so the key locations in the sub-menu will vary. No SCPI command directly controls the Data Type that this key controls. The Data Type is included in the MMEM:LOAD commands.
Dependencies	If a file type is not used by a certain measurement, it is grayed out for that measurement. The key for a file type will not show at all if there are no measurements in the Mode that support it.

Preset	Is not affected by Preset or shutdown, but is reset during Restore Mode Defaults
Readback	The data type that is currently selected
Initial S/W Revision	Prior to A.02.00

Trace

This key selects Trace as the data type to be imported. When pressed a second time, it brings up the Trace Menu, which lets you select the Trace into which the data will be imported.

This key is grayed out when measurements are running that do not support trace importing.

For Vector Signal Analyzer Mode:

The trace data is loaded into the selected data register. Trace data registers are temporary storage places for trace data. They allow you to view past results next to current measurement results, and are also used in some functions like user defined filters. They are measurement global, so you can import data into a register while in the Digital Demod measurement and view it later while in the Vector measurement. Data registers are cleared when the measurement application is terminated, but not when you change Modes and return.

If the recalled file was saved with header information, the trace will initially be displayed with the same formatting and scaling as it had when it was saved. If headers are not saved, the scaling and format are set to defaults when the trace is recalled.

The following trace data formats may be imported:

Text and comma-separated variable (CSV)

Text

SDF.

Option 200 also allows import of these additional formats:

Matlab 4

Matlab 5

Matlab HDF5

N5110A compatible binary

Remote Command	`:MMEMory:LOAD:TRACe:DATA TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,<filename>`
Example	:MMEM:LOAD:TRAC DATA TRACE2,"myTrace2.csv" imports the 2nd trace from the file myTrace2.csv in the current path. The default path is My Documents\SA\data\traces
Key Path	**Recall, Data**

Notes	For VSA Mode: The Open...dialog box has the following filter options when you are recalling trace data: • CSV (Comma delimited) (*.csv) • SDF (Fast) (*.sdf;*.dat) • Text (Tab delimited) (*.txt) • MAT-File (*.mat) • MAT-File (Version 4) (*.mat) • MAT-File (HDF5) (*.mat;*.hdf;*.h5) • N5110A Waveform (*.bin) The file format recalled depends on selection.
Dependencies	Trace data is not available from all Measurements. When unavailable, the key will be grayed out. The key will not show if no measurements in the Mode support it. If any error occurs while trying to load a file manually (as opposed to during remote operation), the analyzer returns to the Import Data menu and the File Open dialog goes away.
Couplings	When a trace is imported, **Trace Update** is always turned OFF for that trace and **Trace Display** is always turned ON.
Readback	Other than VSA: 1|2|3|4|5|6 VSA: Data 1|Data 2|Data 3|Data 4|Data 5|Data 6
Initial S/W Revision	Prior to A.02.00

Trace 1, 2, 3, 4, 5, 6

Enables you to select which Trace to import the data into either 1, 2, 3, 4, 5 or 6. The default is the currently selected trace, which was selected in this menu or in the Trace/Det, Export Data, Recall Trace, or Save Trace menus. The exception is, if you have chosen All then it remains chosen until you specifically change it to a single trace.

Once selected, the key returns back to the Import Data menu and the selected Trace number is annotated on the key. Now you have selected exactly what needs to be imported. To trigger an import of the selected trace, you must select the Open key in the Import Data menu.

An example of using this menu is: If you select 4 and continue to the File Open dialog, then import Trace 4 from the file selected or entered in File Name option in the File Open dialog.

Key Path	**Recall, Data, Trace**
Initial S/W Revision	Prior to A.02.00

Display in Selected Trace

In Vector Signal Analyzer Mode, data registers are used as temporary storage places for trace data.

A register may be displayed in any trace. If the Display in Selected Trace key is set to "Yes" then the data register into which the file is recalled is then assigned to the currently selected trace.

Example	MMEM:LOAD:TRAC:DATA D1,"TRC1.TXT",TXT This command explicitly puts the data in the specified trace.
Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA
Initial S/W Revision	Prior to A.02.00

Capture Buffer

Capture Buffer functionality is not available for all measurements. The captured data is raw data (unprocessed).

Example	MMEM:LOAD:CAPT "MyCaptureData.bin" This loads the file of capture data (on the default file directory path) into the instrument.
Key Path	**Recall, Data**
Mode	WCDMA
Dependencies	Capture buffer data is not available from all Measurements. When unavailable, the key will be grayed out. The key will not show if no measurements in the Mode support it.
Initial S/W Revision	Prior to A.02.00

Zone map

A map file contains zone definitions that help simplify making measurements of frequently used signals. The OFDMA frame structure can contain multiple-zone definitions for the uplink and downlink subframes and multiple data burst allocations. You can recall map files in which you have saved complicated OFDMA frame analysis zone definitions. This can save you time and ensure the accuracy of repeat measurements. Map files are also useful for recreating measurement settings so they can be used by other users.

Example	MMEM:LOAD:ZMAP "MyZonemapFile.omf" This loads the file of zone map data (on the default file directory path) into the custom map.
Key Path	**Recall, Data**
Mode	OFDMA WIMAX
Dependencies	Zone map data is not available from all Measurements.When unavailable, the key will be grayed out. The key will not show if no measurements in the Mode support it.
Initial S/W Revision	Prior to A.02.00

Recorded Data

This allows you to recall previously saved, recorded data for analysis.

This feature is only available with 89601X VSA Option 200 and Option G01.

Example	MMEM:LOAD:REC "MyRecording.sdf"
Key Path	**Recall, Data (Import)**
Mode	VSA
Notes	Available file types are: • CSV (Comma delimited) (*.csv) • MAT-File (*.mat) • MAT-File (Version 4) (*.mat) • MAT-File (HDF5) (*.mat;*.hdf;*.h5) • N5110A Waveform (*.bin) • SDF (Fast) (*.sdf;*.dat) • SDF (Export) (*.sdf;*.dat) • Text (Tab delimited) (*.txt)
Initial S/W Revision	Prior to A.02.00

Open…

Accesses the standard Windows File Open dialog and the File Open key menu. When you navigate to this selection, you have already determinedyou are recalling a specific Data Type and now you want to specify which file to open.

When you first enter this dialog, the path in the Look In: field depends on which import data type you selected.

The only files that are visible are those specific to the file type being recalled.

Key Path	**Recall, Data**
Notes	The key location is mode-dependent and will vary. Brings up Open dialog for recalling a <mode specific> Save Type
Initial S/W Revision	Prior to A.02.00

Open

The import starts by checking for errors. Then the import can start. For all data types, the actual import starts by aborting the currently running measurement. Then the import does data type specific behavior:

File Open Dialog and Menu

The **File Open** is a standard Windows dialog and has a **File Open** key menu. Each key in this menu corresponds to the selectable items in the **File Open** dialog box. The menu keys can be used for easy navigation between the selections within the dialog or the standard **Tab** and **Arrow** keys can be used for dialog navigation. When you navigate to this selection, you have already limited the file recall type and now you want to specify which file to open.

Initial S/W Revision:	Prior to A.02.00

Open

This selection and the **Enter** key, when a filename has been selected or specified,cause the load to occur. **Open** loads the specified or selected file to the previously selected recall type of either **State** or a specific import data type.

Notes	Advisory Event "File <file name> recalled" after recall is complete.
Initial S/W Revision	Prior to A.02.00

File/Folder List

This menu key navigates to the center of the dialog that contains the list of files and folders. Once hereyoucan get information about the file.

Key Path	**Recall, <various>, Open…**
Notes	Pressing this key navigates you to the files and folders list in the center of the dialog.
Initial S/W Revision	Prior to A.02.00

Sort

Accesses a menu that enables you to sort the files within the File Open dialog. Only one sorting type can be selected at a time and the sorting happens immediately.

Key Path	**Recall, <various>, Open…**
Notes	No SCPI command directly controls the sorting.
Initial S/W Revision	Prior to A.02.00

By Date

Accesses a menu that enables you to sort the list of files within the scope of the File Open dialog in ascending or descending data order. The date is the last data modified.

Key Path	**Recall, <various>, Open…, Sort**
Notes	Files in the File Open dialog are sorted immediately in the selected order
Initial S/W Revision	Prior to A.02.00

By Name

Accesses a menu that enables you to sort the list of files within the scope of the File Open dialog in ascending or descending order based on the filename.

Key Path	**Recall, <various>, Open…, Sort**
Notes	Files in the File Open dialog are sorted immediately in the selected order
Initial S/W Revision	Prior to A.02.00

By Extension

Accesses a menu that enables you to sort the list of files within the scope of the File Open dialog in ascending or descending order based on the file extension for each file.

Key Path	**Recall, <various>, Open…, Sort**
Notes	Files in the File Open dialog are sorted immediately in the selected order
Initial S/W Revision	Prior to A.02.00

By Size

Accesses a menu that enables you to sort the list of files within the scope of the File Open dialog in ascending or descending order based on file size.

Key Path	**Recall, <various>, Open…, Sort**
Notes	Files in File Open dialog are sorted immediately in the selected order
Initial S/W Revision	Prior to A.02.00

Ascending

This causes the display of the file list to be sorted, according to the sort criteria, in ascending order.

Key Path	**Recall, <various>, Open…, Sort**
Notes	Files in File Open dialog are sorted immediately in the selected order
Initial S/W Revision	Prior to A.02.00

Descending

This causes the display of the file list to be sorted, according to the sort criteria, in descending order.

Key Path	**Recall, <various>, Open…, Sort**
Notes	Files in File Open dialog are sorted immediately in the selected order
Initial S/W Revision	Prior to A.02.00

Files Of Type

This menu key corresponds to the Files Of Type selection in the dialog. It follows the standard Windows supported Files Of Type behavior. It shows the current file suffix that corresponds to the type of file the user has selected to save. Ifyou navigated here from recalling State, "State File (*.state)" is in the dialog selection and is the only type available in the pull down menu. If you navigated here from recalling Trace, "Trace+State File (*.trace)" is in the dialog selection and is the only type available under the pull down menu.

If younavigated here from importing a data file, the data types available will be dependent on the current measurement and the selection you made under “Import Data”. For example:

Amplitude Corrections: pull down menu shows

Amplitude Corrections (*.csv)

Legacy Cable Corrections (*.cbl)

Legacy User Corrections (*.amp)

Legacy Other Corrections (*.oth)

Legacy Antenna Corrections (*.ant)

Limit: pull down menu shows

Limit Data (*.csv)

Legacy Limit Data (*.lim)

Trace: pull down menu shows

Trace Data (*.csv)

Key Path	**Recall, <various>, Open…**
Notes	Pressing this key causes the pull down menu to list all possible file types available in this context.
Initial S/W Revision	Prior to A.02.00

Up One Level

This menu key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. It follows the standard Windows supported Up One Level behavior. When pressed, it directs the file and folder list to navigate up one level in the directory structure.

Key Path	**Recall, <various>, Open…**
Notes	When pressed, the file and folder list is directed up one level of folders and the new list of files and folders is displayed.
Initial S/W Revision	Prior to A.02.00

Cancel

Cancels the current File Open request. It follows the standard Windows supported Cancel behavior.

Key Path	**Recall, <various>, Open…**
Notes	Pressing this key causes the Open dialog to go away and auto return.
Initial S/W Revision	Prior to A.02.00

Save

Accesses a menu that provides the save type options. The **Save Type** options are **State**, **Trace**, **Data**, or a **Screen Image** depending on the active mode.

Key Path	**Save**
Mode	All
Notes	No remote command for this key specifically.
Initial S/W Revision	Prior to A.02.00

State

Selects **State** as the save type and accesses a menu that provides the options of where to save. You can save either to a register or a file. This menu key will not actually cause the save until the location is chosen.

Saving the state is the only way to save this exact measurement context for the current active mode. The entire state of the active mode is saved in a way that when a recall is requested, the mode will return to as close as possible the context in which the save occurred. This includes all settings and data for only the current active mode.

It should be noted that the Input/Output settings will be saved when saving State, since these settings plus the state of the mode best characterize the current context of the mode, but the mode independent System settings will not be saved.

For rapid saving, the State menu lists registers to save to, or you can select a file to save to. Once they select he destination of the save in the State menu, the save will occur.

Key Path	**Save**
Mode	All
Example	MMEM:STOR:STATe "MyStateFile.state" This stores the current instrument state data in the file MyStateFile.state in the default directory.
Notes	See “Save” on page 161.
Initial S/W Revision	Prior to A.02.00

Register 1 thru Register 6

Selecting any one of these register menu keys causes the State of the currently active mode to be saved to the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified.

These 6 registers are all that is available from the front panel for all modes in the instrument. There are not 6 registers available for each mode. From remote, 127 Registers are available. Registers are files that are visible to the user in the My Documents\System folder.

Key Path	**Save, State**
Mode	All
Example	*SAV 1
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, State**
Mode	All
Example	*SAV 2
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, State**
Mode	All
Example	*SAV 3
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, State**
Mode	All
Example	*SAV 4
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, State**
Mode	All
Example	*SAV 5
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, State**
Mode	All
Example	*SAV 6
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

To File . . .

Accesses a menu that enables you to select the location for saving the State. This menu is similar to a standard Windows® **Save As** dialog.

The default path for all State Files is:

My Documents\<mode name>\state

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer). This path is the **Save In:** path in the **Save As** dialog for all State Files when they first enter this dialog.

Key Path	**Save, State**
Mode	All
Notes	Brings up Save As dialog for saving a State Save Type
Initial S/W Revision	Prior to A.02.00

Save As . . .

Accesses a menu that enables you to select the location where you can save the State. This menu is a standard Windows® dialog with Save As menu keys. The "File Name" field in the Save As dialog is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may replace or modify this filename using the File Name softkey. See the Quick Save key documentation for more on the automatic file naming algorithm.

The default path for all State Files is:

My Documents\<mode name>\state

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

When you first enter this dialog, the path in the **Save In:** field depends on the data type. The only files that are visible are the *.state files and the Save As type is *.state, since .state is the file suffix for the State Save Type.

Key Path	**Save, State**
Mode	All

Notes	Brings up Save As dialog for saving a State Save Type
Initial S/W Revision	Prior to A.02.00

Save

Saves all of the State of the currently active mode plus the system level Input/Output settings to the specified file.

While the save is being performed, the floppy icon shows up in the settings bar near the Continuous/Single sweep icon. After the save completes, the Advisory Event "File <register number> saved" is displayed.

Key Path	**Save, State, To File…**
Mode	All
Remote Command	`:MMEMory:STORe:STATe <filename>`
Example	:MMEM:STOR:STAT "myState.state" saves the file myState.state on the default path
Notes	If the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote. Auto return to the State menu and the Save As dialog goes away.
Backwards Compatibility SCPI	For a backwards compatibility only, the following parameters syntax is supported: :MMEMory:STORe:STATe 1,<filename> The "1" is just ignored. The command is sequential.
Initial S/W Revision	Prior to A.02.00

Trace (+State)

Selects a state file which includes trace data for recalling as the save type and accesses a menu that enables you to select which trace to save.   You can save to either a register or a file. Not all modes support saving trace data with the state, and for modes that do, not all measurements do. This key is grayed out for measurements that do not support trace saves. It is blanked for modes that do not support trace saves. Saving **Trace** is identical to saving State except a .trace extension is used on the file instead of .state, and internal flags are set in the file indicating which trace was saved. You may also select to save ALL traces.

This key will not actually cause the save, since the save feature still needs to know which trace to save and where to save it. Pressing this key accesses the Save Trace menu that provides the user with these options.

For rapid saving, the Trace menu lists registers to save to, or you can select a file to save to. Once you pick the destination of the save in the Trace menu, the save will occur.

Key Path	**Save**
Mode	SA
Example	MMEM:STOR:STATe TRACE2,"MyTraceFile.trace" This stores trace 2 data in the file MyTraceFile.trace in the default directory. :MMEM:STOR:TRAC:REG TRACE1,2 stores trace 1 data in trace register 2 :MMEM:STOR:TRAC:REG ALL,3 saves the data for all 6 traces in trace register 3
Notes	See “Save” on page 161.
Initial S/W Revision	Prior to A.02.00

Register 1 thru Register 5

Selecting any one of these register menu keys causes the Trace(s) specified under From Trace, along with the state of the currently active mode, to be saved to the specified Trace Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified.

These 5 trace registers are all that is available for all modes in the instrument. At present, only the Swept SA measurement of the Spectrum Analyzer mode supports saving to Trace+State files. Registers are files that are visible to the user in the My Documents\System folder.

Key Path	**Save, Trace**
Mode	SA
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, Trace**
Mode	SA
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, Trace**
Mode	SA
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.

Initial S/W Revision	Prior to A.02.00

Key Path	**Save, Trace**
Mode	SA
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

Key Path	**Save, Trace**
Mode	SA
Readback	Date and time with seconds resolution are displayed on the key, or "(empty)" if no prior save operation performed to this register.
Initial S/W Revision	Prior to A.02.00

From Trace

Accesses a menu that enables you to select the trace to be saved. Once a trace is selected, the key returns to the Save Trace menu and the selected trace number is annotated on the key. The default is the currently selected trace, selected in this menu or in the Trace/Det, Export Data, Import Data or Recall Trace menus, except if you have chosen All then it remains chosen until you specifically change it to a single trace. To save the Trace you must select **Save As**.

These keys let you pick which trace to save. Now you have selected exactly what needs to be saved. To trigger a save of the selected **Trace**, you must select the **Save As** key in the Save Trace menu.

Key Path	**Save, Trace + State**
Mode	SA
Initial S/W Revision	Prior to A.02.00

Save As . . .

This menu lets you select the location where you can save the Trace. It is a standard Windows® dialog with Save As menu keys.

The "File Name" field in the Save As dialog is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may replace or modify this filename using the File Name softkey. See the Quick Save key documentation for more on the automatic file naming algorithm.

The default path for all State Files including .trace files is:

My Documents\<mode name>\state

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

When you first enter this dialog, the path in the Save In: field depends on the data type. The only files that are visible are the *.trace files and the Save As type is *.trace, since .trace is the file suffix for the Trace Save Type.

Key Path	**Save, Trace (+State)**
Mode	SA
Notes	Brings up the Save As dialog for saving a Trace Save Type
Initial S/W Revision	Prior to A.02.00

Save

This key initiates the save of the .trace file. All of the State of the currently active mode plus the system level Input/Output settings are saved to the specified file as well as all of the trace data, including internal flags set in the file indicating which trace is to be saved.

While the save is being performed, the floppy icon shows up in the settings bar near the Continuous/Single sweep icon. After the save completes, the Advisory Event "File <register number> saved" is displayed.

Key Path	**Save, Trace, Save As…**
Mode	SA

Remote Command	`:MMEMory:STORe:TRACe TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6|ALL,<filename>`
	
	`:MMEMory:STORe:TRACe:REGister TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6|ALL,<integer>`

Example	:MMEM:STOR:TRAC TRACE1,“myState.trace” saves the file myState.trace on the default path and flags it as a “single trace” file with Trace 1 as the single trace (even though all of the traces are in fact stored). :MMEM:STOR:TRAC ALL,“myState.trace” saves the file myState.trace on the default path and flags it as an “all traces” file :MMEM:STOR:TRAC:REG TRACE1,2 stores trace 1 data in trace register 2
Notes	Some modes and measurements do not have available all 6 traces. The Phase Noise mode command, for example, is: MMEMory:STORe:TRACe TRACE1|TRACE2|TRACE3|ALL,<filename> This command actually performs a save state, which in the Swept SA measurement includes the trace data. However it flags it (in the file) as a “save trace” file of the specified trace (or all traces). The range for the register parameter is 1–5 If the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during a instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote. Auto return to the State menu and the Save As dialog goes away.

Initial S/W Revision	Prior to A.02.00

Data (Export)

Exporting a data file stores data from the current measurement to mass storage files. The Export Menu only contains data types that are supported by the current measurement.

Since the commonly exported data files are in .csv format, the data can be edited by you prior to importing. This allows youto export a data file, manipulate the data in Excel (the most common PC Application for manipulating .csv files) and then import it.

Selecting an Export Data menu key will not actually cause the exporting to occur, since the analyzer still needs to know where you wish to save the data. Pressing the Save As key in this menu brings up the Save As dialog and Save As menu that allows you to specify the destination file and directory. Once a filename has been selected or entered in the Open menu, the export will occur as soon as the Save key is pressed.

Key Path	**Save**
Mode	All
Notes	The menu is built from whatever data types are available for the mode. So the key locations in the sub menu will vary. No SCPI command directly controls the Data Type that this key controls. The Data Type is included in the MMEM:STORe commands.
Dependencies	If a file type is not used by a certain measurement, that type is grayed out for that measurement. The key for a file type will not show at all if there are no measurements in the Mode that support it.
Preset	Is not affected by a Preset or shutdown, but is reset during Restore Mode Defaults
Readback	The data type that is currently selected
Initial S/W Revision	Prior to A.02.00

Trace

Enables you to select Traces as the data type to be exported. Pressing this key when it is already selected brings up the Trace menu, which allows you to select which Trace to save.

The trace file contains “meta” data, which describes the current state of the analyzer.

Key Path	**Save, Data**
Remote Command	`:MMEMory:STORe:TRACe:DATA TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6|ALL,<filename>`

Example	:MMEM:STOR:TRAC:DATA TRACE2,"myTrace2.csv" exports the 2nd trace to the file myTrace2.csv in the current path. The default path is My Documents\SA\data\traces VSA Example: MMEM:STOR:TRAC:DATA TRACE1,"Trc1.txt",TXT,ON
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	Trace data is not available from all Measurements. When unavailable, the key will be grayed out. The key will not show if no measurements in the Mode support it.
Readback	Swept SA: 1|2|3|4|5|6|ALL Analog Demod Mode: RF Spectrum|Demod|Demod Ave|Demod Max|Demod Min|AF Spectrum Vector Signal Analyzer: Trace 1|Trace 2 with header|Trace 2|Trace 2 with header|Trace 3|Trace 3 with header|Trace 4|Trace 4 with header|Trace 5|Trace 5 with header|Trace 6|Trace 6 with header|
Initial S/W Revision	Prior to A.02.00

Trace selection

Enables you to select which Trace to save. The traces may have names, or they may be labeled 1, 2, 3, 4, 5, or 6, depending on the current mode. Once selected, the key returns back to the Export Data menu and the selected trace name/number is annotated on the key. The default is the currently selected trace, selected in this menu or in the Trace/Det, Import Data, Recall Trace or Save Trace menus. The exception is, if you have chosen All then it remains chosen until you specifically change it to a single trace.

To trigger a save of the selected trace, you must select the Save As key in the Export Data menu.

Some measurements have an "ALL" selection. This saves all six traces in one .csv file with the x-axis data in the first column and the individual trace data in succeeding columns. The header data and x-axis data in this file reflect the current settings of the measurement. Note that any traces which are in View or Blank may have different x-axis data than the current measurement settings, but this data will not be output to the file.

Key Path	**Save, Data, Trace**
Mode	SA|Analog Demod|VSA
Preset	The first trace key shown.
Initial S/W Revision	Prior to A.02.00

Include Header

The trace header information includes enough state information to display the trace data with the same formatting and scaling when it is recalled. However, no other instrument state information is saved. If headers are not saved, the scaling and format are set to defaults when the trace is recalled.

Example	MMEM:STOR:TRAC:DATA TRACE1,"Trc1.txt",TXT,ON The On/Off setting is the last variable passed in the MMEMory:STORe:TRACe:DATA command.
Key Path	**Save, Data, Trace**
Mode	VSA
Preset	On
Initial S/W Revision	Prior to A.02.00

Measurement Results

Different types of results are available for each particular measurement. The results that are available are documented under the individual measurements. These measurement results are the same as the results that are returned when using the MEASure:<measurement> command (usually for sub-opcode 1).

Measurement results may not be available for all measurements.

Example	MMEM:STOR:RES "MyResultsFile.xml" This stores the measurement results data in the file MyResultsFile.xml in the default directory.
Key Path	**Save, Data**
Mode	SA|ADEMOD|BASIC(IQ Analyzer)|CDMA2K|GSMEDGE|PNOISE|WCDMA|WIMAXOFDMA|TDS CDMA
Notes	The key will not show if no measurements in the Mode support it.
Initial S/W Revision	Prior to A.02.00

Capture Buffer

Capture Buffer functionality is not available for all measurements. The captured data is raw data (unprocessed).

Example	MMEM:STOR:CAPT "MyCaptureData.bin" This stores the capture data in the file MyCaptureData.bin in the default directory.
Key Path	**Save, Data**
Mode	WCDMA
Notes	The key will not show if no measurements in the Mode support it.
Initial S/W Revision	Prior to A.02.00

Zone map

A map file contains zone definitions that will help simplify making measurements of frequently used signals. The OFDMA frame structure can contain multiple-zone definitions for the uplink and downlink subframes and multiple data burst allocations. You can store map files in which you have saved complicated OFDMA frame analysis zone definitions. This can save you time and ensure the accuracy of repeated measurements. map files are also useful for recreating measurement settings so they can be used by other users.

Example	MMEM:STOR:ZMAP "MyZonemapFile.omf" This stores the zone map data in the file MyZonemapFile.omf in the default directory.
Key Path	**Save, Data**
Mode	OFDMA WiMAX
Notes	The key will not show if no measurements in the Mode support it.
Initial S/W Revision	Prior to A.02.00

Recorded Data

Saving recorded data is not available for all measurements. Recorded data, and the optional header info, may be recalled later (or transferred to another instrument) for analysis.

This function is available in 89601X VSA Option 200, but not in Option 205.

Example	MMEM:STOR:REC "MyRecording.sdf",SDF,ON,ON,OFF
Key Path	**Save, Data (Export)**
Mode	VSA
Notes	Grayed out unless there is recorded data in the buffer.
Initial S/W Revision	Prior to A.02.00

Save As . . .

This menu lets you select the location where you can save Data Type files. It is a standard Windows® dialog with Save As menu keys. The "File Name" field in the Save As dialog is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may replace or modify this filename using the File Name key. See the Quick Save key documentation for more on the automatic file naming algorithm.

When you first enter this dialog, the path in the Save In: field depends on the data type. The only files that are visible are the files with the corresponding data type suffix, and the **Save As** type lists the same suffix.

For example, if the Data Type is **Amplitude Corrections**, the file suffix is .csv and the *.csv files are the only visible files in the **Save As** dialog and .csv is the Save As Type.

The default path for saving files is:

For all of the Trace Data Files:

My Documents\<mode name>\data\traces

For all of the Limit Data Files:

My Documents\<mode name>\data\limits

For all of the Measurement Results Data Files:

My Documents\<mode name>\data\<measurement name>\results

For all of the Capture Buffer Data Files:

My Documents\<mode name>\data\captureBuffer

Key Path	**Save, Data**
Mode	All
Notes	The key location is mode-dependent and will vary. Brings up the Save As dialog for saving a <mode specific> Save Type
Initial S/W Revision	Prior to A.02.00

Save

Saves the specified Data Type. This section describes any specific save behavior relevant to Data that is common to all modes.

When a Save of a specific Data File is requested, the specified data is saved to the specified or selected file. The save is performed immediately and does not wait until the measurement is complete.

If the file already exists, a dialog will appear that allows you to replace the existing file by selecting **OK** or you can **Cancel** the request.

While the save is being performed, the floppy icon will show up in the settings bar near the Continuous/Single icon. After a register save completes, the corresponding register softkey annotation is updated with the date the time and an advisory message that the file was saved appears in the message bar.

Key Path	**Save, Data, Save As…**
Notes	If the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during a instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote.
Initial S/W Revision	Prior to A.02.00

Screen Image

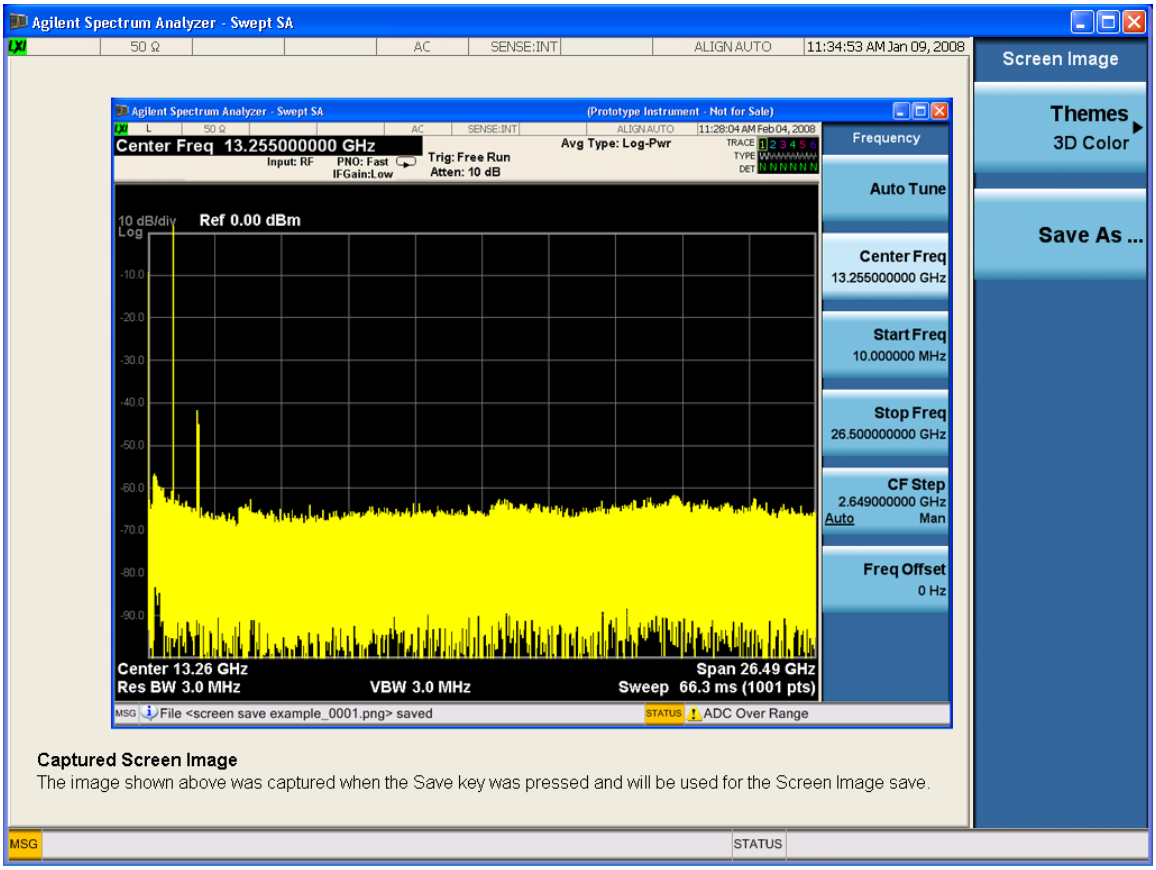
Accesses a menu of functions that enable you to specify a format and location for the saved screen image.

Pressing Screen Image brings up a menu that allows you to specify the color scheme of the Screen Image

(Themes) or navigate to the Save As dialog to perform the actual save.

Screen Image files contain an exact representation of the analyzer display. They cannot be loaded back onto the analyzer, but they can be loaded into your PC for use in many popular applications.

The image to be saved is actually captured when the **Save** front panel key is pressed, and kept in temporary storage to be used if the user asks for a Screen Image save. When the Screen Image softkey is pressed, a "thumbnail" of the captured image is displayed, as shown below:



When you continue on into the **Save As** menu and complete the Screen Image save, the image depicted in the thumbnail is the one that gets saved, showing the menus that were on the screen before going into the **Save** menus.

After you have completed the save, the **Quick Save** front-panel key lets you quickly repeat the last save performed, using an auto-named file, with the current screen data.

NOTE	For versions previous to A.01.55, if you initiate a screen image save by navigating through the Save menus, the image that is saved will contain the Save menu softkeys, not the menus and the active function that were on the screen when you first pressed the Save front panel key.

Key Path	**Save**

Mode	All
Example	MMEM:STOR:SCR "MyScreenFile.png" This stores the current screen image in the file MyScreenFile.png in the default directory.
Notes	See
Initial S/W Revision	Prior to A.02.00

Themes

Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image.

The **Themes** option is the same as the **Themes** option under the **Display** and **Page Setup** dialogs. It allows you to choose between themes to be used when saving the screen image.

Key Path	**Save, Screen Image**
Remote Command	`:MMEMory:STORe:SCReen:THEMe TDColor|TDMonochrome|FCOLor|FMONochrome` `:MMEMory:STORe:SCReen:THEMe?`
Example	:MMEM:STOR:SCR:THEM TDM
Preset	3D Color; Is not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the modes.
Readback	3D Color | 3D Mono | Flat Color | Flat Mono
Initial S/W Revision	Prior to A.02.00

3D Color

Selects a standard color theme with each object filled, shaded and colored as designed.

Key Path	**Save, Screen Image, Themes**
Example	MMEM:STOR:SCR:THEM TDC
Readback	3D Color
Initial S/W Revision	Prior to A.02.00

3D Monochrome

Selects a format that is like 3D color but shades of gray are used instead of colors.

Key Path	**Save, Screen Image, Themes**
Example	MMEM:STOR:SCR:THEM TDM
Readback	3D Mono

Initial S/W Revision	Prior to A.02.00

Flat Color

Selects a format that is best when the screen is to be printed on an ink printer.

Key Path	**Save, Screen Image, Themes**
Example	MMEM:STOR:SCR:THEM FCOL
Readback	Flat Color
Initial S/W Revision	Prior to A.02.00

Flat Monochrome

Selects a format that is like Flat Color. But only black is used (no colors, not even gray), and no fill.

Key Path	**Save, Screen Image, Themes**
Example	MMEM:STOR:SCR:THEM FMON
Readback	Flat Mono
Initial S/W Revision	Prior to A.02.00

Save As…

Accesses a menu that enables you to select the location where you can save the Screen Image. This menu is a standard Windows® dialog with Save As menu keys. The **Save As** dialog is loaded with the file information related to the Screen Image Type. The filename is filled in using the auto file naming algorithm for the Screen Image Type and is highlighted. The only files that are visible are the *.png files and the Save As Type is *.png, since .png is the file suffix for the Screen Image Type.

The default path for Screen Images is

My Documents\<mode name>\screen.

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

This path is the **Save In:** path in the **Save As** dialog for all Screen Files when you first enter this dialog.

Key Path	**Save, Screen Image**
Notes	Brings up Save As dialog for saving a Screen Image Save Type
Initial S/W Revision	Prior to A.02.00

Save

Saves the screen image to the specified file using the selected theme. The image that is saved is the measurement display prior to when the **Save As** dialog appeared. The save is performed immediately and does not wait until the measurement is complete.

Key Path	**Save, Screen Image, Save As…**
Remote Command	`:MMEMory:STORe:SCReen <filename>`
Example	:MMEM:STOR:SCR "myScreen.png"
Notes	If the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during a instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote. Auto return to the Screen Image menu and the Save As dialog goes away. Advisory Event "File <file name> saved" after save is complete.
Initial S/W Revision	Prior to A.02.00

Save As . . .

Accesses a standard Windows dialog with the **Save As** key menu. The "File Name" field in the Save As dialog is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may replace or modify this filename using the File Name key. See the Quick Save key documentation for more on the automatic file naming algorithm.

The **Save As** dialog has the last path loaded in **Save In:** for this particular file type. User specified paths are remembered and persist through subsequent runs of the mode. These remembered paths are mode specific and are reset back to the default using **Restore Mode Defaults**.

Initial S/W Revision:	Prior to A.02.00

Save

Performs the actual save to the specified file of the selected type. The act of saving does not affect the currently running measurement and does not require you to be in single measurement mode to request a save. It performs the save as soon as the currently running measurement is in the idle state; when the measurement completes. This ensures the State or Data that is saved includes complete data for the current settings. The save only waits for the measurement to complete when the state or data that depends on the measurement setup is being saved. The save happens immediately when exporting corrections or when saving a screen image.

If the file already exists, a dialog appears with corresponding menu keys that allowyou to replace the existing file with an **OK** or to **Cancel** the request.

While the save is being performed, the floppy icon shows up in the settings bar near the Continuous/Single icon. After the save completes, the corresponding register menu key annotation is updated with the date the time and the message "File <file name> saved" appears in the message bar.

Notes	If the file already exists, the File Exist dialog appears and allows you to replace it or not by selecting the Yes or No menu keys that appear with the dialog.Then the key causes an auto return and Save As dialog goes away. Advisory Event "File <file name> saved" after save is complete.
Initial S/W Revision	Prior to A.02.00

File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file.

Key Path	**Save, <various>, Save As…**
Notes	Pressing this key enables you to navigate to the files and folders list in the center of the dialog.
Initial S/W Revision	Prior to A.02.00

File Name

Accesses the Alpha Editor. Use the knob to choose the letter to add and the Enter front-panel key to add the letter to the file name. In addition to the list of alpha characters, this editor includes a **Space** key and a **Done** key. The **Done** key completes the filename, removes the Alpha Editor and returns back to the **File Open** dialog and menu, but does not cause the save to occur. You can also use **Enter** to complete the file name entry and this will cause the save to occur.

Key Path	**Save, <various>, Save As…**
Notes	Brings up the Alpha Editor. Editor created file name is loaded in the File name field of the Save As dialog.
Initial S/W Revision	Prior to A.02.00

Save As Type

This key corresponds to the **Save As Type** selection in the dialog. It follows the standard Windows® supported **Save As Type** behavior. It shows the current file suffix that corresponds to the type of file you have selected to save. If you navigated here from saving State, "State File (*.state)" is in the dialog selection and is the only type available under the pull down menu. If you navigated here from saving Trace, "Trace+State File (*.trace)" is in the dialog selection and is the only type available under the pull down menu. If you navigated here from exporting a data file, "Data File (*.csv)" is in the dialog and is available in the pull down menu. Modes can have other data file types and they would also be listed in the pull down menu.

Key Path	**Save, <various>, Save As…**
Notes	Pressing this key causes the pull down menu to list all possible file types available in this context. All types available are loaded in a 1-of-N menu key for easy navigation.

Initial S/W Revision	Prior to A.02.00

Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. It follows the standard Windows® supported **Up One Level** behavior. When pressed, it causes the file and folder list to navigate up one level in the directory structure.

Key Path	**Save, <various>, Save As…**
Notes	When pressed, the file and folder list is directed up one level of folders and the new list of files and folders is displayed
Initial S/W Revision	Prior to A.02.00

Create New Folder

This key corresponds to the icon of a folder with the "*" that is in the tool bar of the dialog. It follows the standard Windows® supported **Create New Folder** behavior. When pressed, a new folder is created in the current directory with the name **New Folder** and allows you to enter a new folder name using the Alpha Editor.

Key Path	**Save, <various>, Save As…**
Notes	Creates a new folder in the current folder and lets the user fill in the folder name using the Alpha Editor.
Initial S/W Revision	Prior to A.02.00

Cancel

This key corresponds to the **Cancel** selection in the dialog. It follows the standard Windows supported **Cancel** behavior. It causes the current **Save As** request to be cancelled.

Key Path	**Save, <various>, Save As…**
Notes	Pressing this key causes the Save As dialog to go away and auto return.
Initial S/W Revision	Prior to A.02.00

Mass Storage Catalog (Remote Command Only)

Remote Command:	:MMEMory:CATalog? [<directory_name>]
Notes:	The string must be a valid logical path. Query disk usage information (drive capacity, free space available) and obtain a list of files and directories in a specified directory in the following format: <numeric_value>,<numeric_value>,{<file_entry>} It shall return two numeric parameters and as many strings as there are files and directories. The first parameter shall indicate the total amount of storage currently used in bytes. The second parameter shall indicate the total amount of storage available, also in bytes. The <file_entry> is a string. Each <file_entry> shall indicate the name, type, and size of one file in the directory list: <file_name>,<file_type>,<file_size> As windows file system has an extension that indicates file type, <file_type> is always empty. <file_size> provides the size of the file in bytes. In case of directories, <file_entry> is surrounded by square brackets and both <file_type> and <file_size> are empty.
Initial S/W Revision:	Prior to A.02.00

Mass Storage Change Directory (Remote Command Only)

Remote Command:	:MMEMory:CDIRectory [<directory_name>] :MMEMory:CDIRectory?
Notes:	The string must be a valid logical path. Changes the default directory for a mass memory file system. The <directory_name> parameter is a string. If no parameter is specified, the directory is set to the *RST value. At *RST, this value is set to the default user data storage area, that is defined as System.Environment.SpecialFolder.Personal. Query returns full path of the default directory.
Initial S/W Revision:	Prior to A.02.00

Mass Storage Copy (Remote Command Only)

Remote Command:	:MMEMory:COPY <string>,<string>[,<string>,<string>]

Notes:	The string must be a valid logical path. Copies an existing file to a new file or an existing directory to a new directory. Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination. The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists.

Mass Storage Delete (Remote Command Only)

Remote Command:	`:MMEMory:DELete <file_name>[,<directory_name>]`
Notes:	The string must be a valid logical path. Removes a file from the specified directory. The <file_name> parameter specifies the file name to be removed.
Initial S/W Revision:	Prior to A.02.00

Mass Storage Data (Remote Command Only)

Creates a file containing the specified data OR queries the data from an existing file.

Remote Command:	`:MMEMory:DATA <file_name>, <data>` `:MMEMory:DATA? <file_name>`
Notes:	The string must be a valid logical path. The command form is MMEMory:DATA <file_name>,<data>. It loads <data> into the file <file_name>. <data> is in 488.2 block format. <file_name> is string data. The query form is MMEMory:DATA? <file_name> with the response being the associated <data> in block format.
Initial S/W Revision:	Prior to A.02.00

Mass Storage Make Directory (Remote Command Only)

Remote Command:	`:MMEMory:MDIRectory <directory_name>`
Notes:	The string must be a valid logical path. Creates a new directory. The <directory_name> parameter specifies the name to be created.
Initial S/W Revision:	Prior to A.02.00

Mass Storage Move (Remote Command Only)

Remote Command:	`:MMEMory:MOVE <string>,<string>[,<string>,<string>]`
Notes:	The string must be a valid logical path. Moves an existing file to a new file or an existing directory to a new directory. Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination. The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists.
Initial S/W Revision:	Prior to A.02.00

Mass Storage Remove Directory (Remote Command Only)

Remote Command:	`:MEMMory:RDIRectory <directory_name>`
Notes:	The string must be a valid logical path. Removes a directory. The <directory_name> parameter specifies the directory name to be removed. All files and directories under the specified directory shall also be removed.
Initial S/W Revision:	Prior to A.02.00

System

Opens a menu of keys that access various configuration menus and dialogs.

Key Path	**Front-panel key**
Notes	No remote command for this key specifically.
Initial S/W Revision	Prior to A.02.00

Show

Accesses a menu of choices that enable you to select the information window you want to view.

Key Path	**System**
Mode	All
Remote Command	`:SYSTem:SHOW OFF|ERRor|SYSTem|HARDware|LXI|HWSTatistics|ALIGNment|SOFTware` `:SYSTem:SHOW?`
Example	:SYST:SHOW SYST
Notes	This command displays (or exits) the various System information screens.
Preset	OFF
State Saved	No
Range	OFF| ERRor | SYSTem | HARDware | LXI | HWSTatistics | ALIGNment | SOFTware
Initial S/W Revision	Prior to A.02.00

Errors

There are two modes for the Errors selection, History and Status.

The list of errors displayed in the Errors screen does not automatically refresh. You must press the Refresh key or leave the screen and return to it to refresh it.

History brings up a screen displaying the event log in chronological order, with the newest event at the top. The history queue can hold up to 100 messages (if a message has a repeat count greater than 1 it only counts once against this number of 100). Note that this count bears no relation to the size of the SCPI queue. If the queue extends onto a second page, a scroll bar appears to allow scrolling with a mouse. Time is displayed to the second.

Status brings up a screen summarizing the status conditions currently in effect. Note that the time is displayed to the second.

The fields on the Errors display are:

Type (unlabelled) - Displays the icon identifying the event or condition as an error or warning.

ID - Displays the error number.

Message - Displays the message text.

Repeat (RPT) - This field shows the number of consecutive instances of the event, uninterrupted by other events. In other words, if an event occurs 5 times with no other intervening event, the value of repeat will be 5.

If the value of Repeat is 1 the field does not display. If the value of Repeat is >1, the time and date shown are those of the most recent occurrence. If the value of repeat reaches 999,999 it stops there.

Time - Shows the most recent time (including the date) at which the event occurred.

Key Path	**System, Show**
Mode	All
Remote Command	`:SYSTem:ERRor[:NEXT]?`
Example	:SYST:ERR?
Notes	The return string has the format: “<Error Number>,<Error>” Where <Error Number> and <Error> are defined in the Master Error Messages document.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Next Page

Next Page and Previous Page menu keys move you between pages of the log, if it fills more than one page. These keys are grayed out in some cases:

If on the last page of the log, the Next Page key is grayed out

If on the first page of the log, the Previous Page key is grayed out.

If there is only one page, both keys are grayed out.

Key Path	**System, Show, Errors**
Initial S/W Revision	Prior to A.02.00

Previous Page

See “Next Page” on page 177.

Key Path	**System, Show, Errors**
Initial S/W Revision	Prior to A.02.00

History

The History and Status keys select the Errors view. The Status key has a second line which shows a number in [square brackets]. This is the number of currently open status items.

Key Path	**System, Show, Errors**
Initial S/W Revision	Prior to A.02.00

Status

See "History" on page 178

Verbose SCPI On/Off

This is a capability that will allow the SCPI data stream to be displayed when a SCPI error is detected, showing the characters which stimulated the error and several of the characters preceding the error.

Key Path	**System, Show, Errors**
Mode	All
Remote Command	`:SYSTem:ERRor:VERBose OFF|ON|0|1` `:SYSTem:ERRor:VERBose?`
Example	:SYST:ERR:VERB ON
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Misc"
Preset	OFF
State Saved	No
Range	On | Off
Initial S/W Revision	Prior to A.02.00

Refresh

When pressed, refreshes the Show Errors display.

Key Path	**System, Show, Errors**
Initial S/W Revision	Prior to A.02.00

Clear Error Queue

This clears all errors in all error queues.

Note the following:

Clear Error Queue does not affect the current status conditions.

Mode Preset does not clear the error queue.

Restore System Defaults will clear all error queues.

*CLS only clears the queue if it is sent remotely and *RST does not affect any error queue.

Switching modes does not affect any error queues.

Key Path	**System, Show, Errors**
Initial S/W Revision	Prior to A.02.00

System

The System screen is formatted into three groupings: product descriptive information, options tied to the hardware, and software products:

```
<Product Name> <Product Description>
Product Number: N9020A
Serial Number: US46220924
Firmware Revision: A.01.01
Computer Name: <hostname>
Host ID: N9020A,US44220924

N9020A-503      Frequency Range to 3.6 GHz
N9020A-PFR      Precison Frequency Reference
N9020A-P03      Preamp 3.6 GHz

N9060A-2FP      Spectrum Analysis Measurement Suite   1.0.0.0
N9073A-1FP      WCDMA                                 1.0.0.0
N9073A-2FP      WCDMA with HSDPA                      1.0.0.0
```

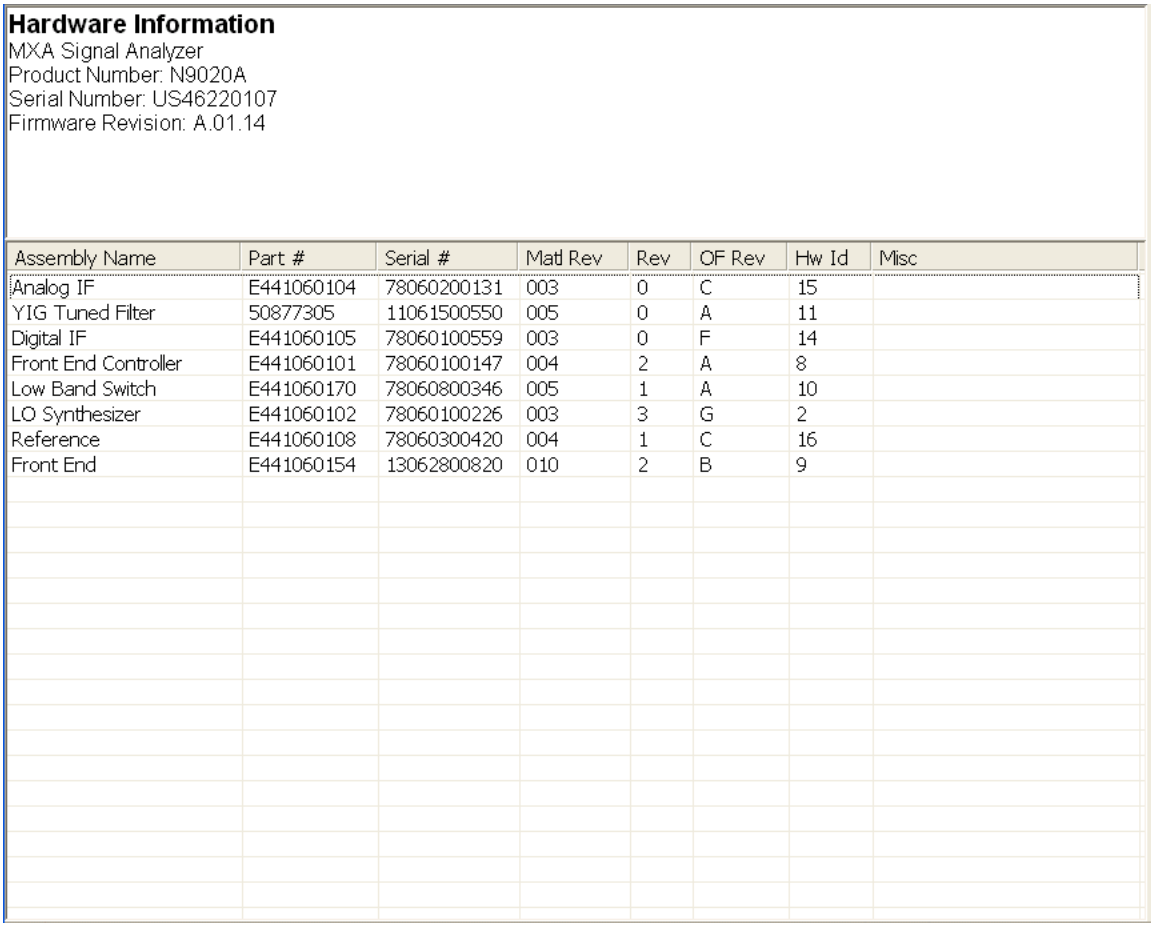
The Previous Page is grayed-out if the first page of information is presently displayed. The Next Page menu key is grayed-out if the last page is information is presently displayed.

Key Path	**System, Show**
Mode	All
Example	SYST:SHOW SYST
Initial S/W Revision	Prior to A.02.00

Hardware

The show hardware screen is used to view details of the installed hardware. This information can be used to determine versions of hardware assemblies and field programmable devices, in the advent of future upgrades or potential repair needs.

The screen is formatted into two groupings: product descriptive information and hardware information. The hardware information is listed in a table format:



Hardware Information
MXA Signal Analyzer
Product Number: N9020A
Serial Number: US46220107
Firmware Revision: A.01.14

Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	E441060104	78060200131	003	0	C	15	
YIG Tuned Filter	50877305	11061500550	005	0	A	11	
Digital IF	E441060105	78060100559	003	0	F	14	
Front End Controller	E441060101	78060100147	004	2	A	8	
Low Band Switch	E441060170	78060800346	005	1	A	10	
LO Synthesizer	E441060102	78060100226	003	3	G	2	
Reference	E441060108	78060300420	004	1	C	16	
Front End	E441060154	13062800820	010	2	B	9	

The Previous Page is grayed-out if the first page of information is presently displayed. The Next Page menu key is grayed-out if the last page is information is presently displayed.

Key Path	**System, Show**
Mode	All
Example	SYST:SHOW HARD
Initial S/W Revision	Prior to A.02.00

LXI

This key shows you the product number, serial number, firmware revision, computer name, IP address, Host ID, LXI Class, LXI Version, MAC Address, and the Auto-MDIX Capability.

Key Path	**System, Show**
Initial S/W Revision	Prior to A.02.00

LXI Event Log

The event log records all of the LXI LAN event activity. As LXI LAN events are sent or received, the activity is noted in the Event Log with an IEEE 1588 timestamp. When the event log is selected, the current contents of the event log are displayed in the system information screen.

The fields recorded in the Event Log are:

- The date the event occurred (GMT)
- The time the event occurred (GMT)
- The type of event: LAN Input, LAN Output, Status, Alarm, Trigger Alarm, Trigger LAN
- The name of the event
- The edge associated with the event
- The event's identifier: This is the string that appears on the LAN.
- The source event: This is only valid for LAN Output, Trigger LAN, and Trigger Alarm event types.
- The source address: This is only valid for LAN Input event types. It is the address from which the message originated.
- The destination address: This is only valid for LAN Output event types. It is the address (or addresses) that the message will be sent to. For UDP messages, this field reads "ALL."

Key Path	**System, Show, LXI**
Initial S/W Revision	Prior to A.02.00

Next Page

See "Next Page" on page 177.

Key Path	**System, Show, Errors**
Initial S/W Revision	Prior to A.02.00

Previous Page

See "Next Page" on page 177

Key Path	**System, Show, Errors**
Initial S/W Revision	Prior to A.02.00

Circular

Sets the behavior for entries that occur while the LXI Event Log is full.

- If Circular is set to 1, incoming events overwrite the oldest events in the log.
- If Circular is set to 0, incoming events are discarded.

Key Path	**System, Show, LXI, LXI Event Log**

Remote Command	`:LXI:EVENt:LOG:CIRCular[:ENABle] ON|OFF|1|0` `:LXI:EVENt:LOG:CIRCular[:ENABle]?`
Example	:LXI:EVEN:LOG:CIRC 1
Preset	ON
Preset	Not affected by a Preset. The default value of "ON" can be restored by pressing **System, Restore Defaults, Misc.**
State Saved	Saved in instrument state.
Range	OFF|ON|0|1
Initial S/W Revision	Prior to A.02.00

Clear

Clears the event log of all entries.

Key Path	**System, Show, LXI, LXI Event Log**
Remote Command	`:LXI:EVENt:LOG:CLEar`
Example	:LXI:EVEN:LOG:CLE
Initial S/W Revision	Prior to A.02.00

Size

Sets the maximum number of entries the LXI Event Log can hold.

Key Path	**System, Show, LXI, LXI Event Log**
Remote Command	`:LXI:EVENt:LOG:SIZE <size>` `:LXI:EVENt:LOG:SIZE?`
Example	:LXI:EVEN:LOG:SIZE 256
Preset	64
Preset	Not affected by a Preset. The default value of "64" can be restored by pressing **System, Restore Defaults, Misc**.
State Saved	Saved in instrument state.
Range	>= 0
Initial S/W Revision	Prior to A.02.00

Enabled

Enables and disables the logging of LXI Events.

Key Path	**System, Show, LXI, LXI Event Log**

Remote Command	`:LXI:EVENt:LOG:ENABle ON|OFF|1|0` `:LXI:EVENt:LOG:ENABle?`
Example	:LXI:EVEN:LOG:ENAB ON
Preset	ON
Preset	Not affected by a Preset. The default value of "ON" can be restored by pressing **System, Restore Defaults, Misc.**
State Saved	Saved in instrument state.
Range	ON|OFF|0|1
Initial S/W Revision	Prior to A.02.00

Count (Remote Command Only)

Returns the number of entries currently in the LXI Event Log.

Remote Command:	`:LXI:EVENt:LOG:COUNt?`
Example:	:LXI:EVEN:LOG:COUN?
Range:	0 – Size
Initial S/W Revision:	Prior to A.02.00

Next Entry (Remote Command Only)

Returns the oldest entry from the LXI Event Log and removes it from the log. If the log is empty, an empty string is returned.

Remote Command:	`:LXI:EVENt:LOG[:NEXT]?`
Example:	:LXI:EVEN:LOG?
Initial S/W Revision:	Prior to A.02.00

All (Remote Command Only)

Non-destructively retrieves the entire contents of the event log. Entries are returned as separate strings, surrounded by double quote marks, and separated by a comma. Fields within each entry are also comma delimited.

Remote Command:	`:LXI:EVENt:LOG:ALL?`
Example:	:LXI:EVEN:LOG:ALL? !Returns the entire event log contents. An example may look like the following: "11/12/2007,18:14:10.770385,Error,LogOverwrite,Rise,,,,","11/12/2007,18:14:10.592105,Status,Measuring,Rise,,,,","11/12/2007,18:14:10.597758,Status,Measuring,Fall,,,,","11/12/2007,18:14:10.597786,Status,Sweeping,Fall,,,,","11/12/2007,18:14:10.599030,Status,WaitingForTrigger,Rise,,,," The contents of the Event Log vary, based on the operation of the instrument.

Initial S/W Revision:	Prior to A.02.00

Specific Entry (Remote Command Only)

Non-destructively retrieves a specifically indexed entry from the event log. Fields within an entry are comma delimited.

Remote Command:	`:LXI:EVENt:LOG:ENTRy? <intIndex>`
Example:	:LXI:EVEN:LOG:ENTR? 0 !Returns the first entry in the event log. An example may look like the following: "11/12/2007,18:14:10.770385,Error,LogOverwrite,Rise,,,," The contents of the Event Log vary, based on the operation of the instrument.
Initial S/W Revision:	Prior to A.02.00

Beginning Entry (Remote Command Only)

Sets or freezes the beginning entry of the log when in circular mode to the most recently added entry at the time of the command. This is so that the :LXI:EVENt:LOG:ENTtry? command has a reference entry for indexing individual entries in the log.

Remote Command:	`:LXI:EVENt:LOG:CIRCular:FBENtry`
Example:	:LXI:EVEN:LOG:CIRC:FBEN
Initial S/W Revision:	Prior to A.02.00

Power On

Enables you to select how the instrument should power on. The options are: Mode and Input/Output Defaults, User Preset and Last State.

Key Path	**System**
Mode	All
Remote Command	`:SYSTem:PON:TYPE MODE|USER|LAST|PRESet` `:SYSTem:PON:TYPE?`
Example	:SYST:PON:TYPE MODE
Preset	MODE
Preset	This is unaffected by a Preset but is set to Mode on a “Restore System Defaults->All”
State Saved	No
Initial S/W Revision	Prior to A.02.00

Mode and Input/Output Defaults

When the analyzer is powered on in Mode and Input/Output Defaults, it will perform a Restore Mode Defaults to all modes in the instrument and a Restore Input/Output Defaults as well.

Key Path	**System, Power On**
Mode	All
Example	SYST:PON:TYPE MODE
Readback Text	Defaults
Initial S/W Revision	Prior to A.02.00

User Preset

Sets **Power On** to **User Preset**. When the analyzer is powered on in User Preset, it will User Preset each mode and switch to the power-on mode. Power On User Preset will not affect any settings beyond what a normal User Preset affects.

NOTE An instrument could never power up for the first time in User Preset.

Key Path	**System, Power On**
Mode	All
Example	SYST:PON:TYPE USER
Readback Text	User Preset
Initial S/W Revision	Prior to A.02.00

Last State

Sets **Power On** to **Last.** When the analyzer is powered on, it will put all modes in the last state they were in prior to when the analyzer was put into Power Standby and it will wake up in the mode it was last in prior to powering off the instrument. The saving of the active mode prior to shutdown happens behind the scenes when a controlled shutdown is requested by using the front panel power **Standby** key or by using the remote command SYSTem:PDOWn. The non-active modes are saved as they are deactivated and recalled by Power On Last State.

NOTE An instrument could never power up for the first time in Last.

If line power to the analyzer is interrupted, for example by pulling the line cord plug or by switching off power to a test rack, Power On Last State will not work properly.

Key Path	**System, Power On**
Mode	All
Example	SYST:PON:TYPE LAST
Notes	Power on Last State only works if the user has done a controlled shutdown prior to powering on in Last. If a controlled shutdown is not done when in Power On Last State, the instrument will power up in the last active mode, but it may not power up in the active mode's last state. If an invalid mode state is detected, a Mode Preset will occur. To control the shutdown under remote control use the :SYSTem:PDOWn command.
Readback Text	Last State
Initial S/W Revision	Prior to A.02.00

Power On Application

Accesses a menu that lists the available Modes and lets you select which Mode is to be the power-on application.

This application is used for Power On Type "Mode and Input/Output Defaults" and Restore System Defaults All.

Key Path	**System, Power On**
Mode	All
Remote Command	`:SYSTem:PON:MODE SA|BASIC|ADEMOD|NFIGURE|PNOISE|CDMA2K|TDSCDMA|VSA|VSA89601|WCDMA|WIMAXOFDMA` `:SYSTem:PON:MODE?`
Example	SYST:PON:MODE SA
Notes	The list of possible modes (and remote parameters) to choose from is dependent on which modes are installed in the instrument.
Preset	SA
Preset	This is unaffected by a Preset but is set on a "Restore System Defaults->All" to SA.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Configure Applications

The Configure Applications utility lets you do two things:

1. specify a subset of the available applications (Modes) to preload into memory at startup time
2. specify the order in which the Modes appear in the Mode menu

There are several reasons you might want to specify a subset of the available applications (Modes) to preload:

- During runtime, if a Mode which is not preloaded is selected by the user, there will be a pause while the Application is loaded. Configure Applications lets you decide whether you want that delay at startup of the analyzer program or the first time you select the Mode.
- In addition, there are more applications available for the X-Series than can fit into Windows Virtual Memory. The Configure Application utility allows you to choose which licensed applications to load into memory, if you have more licensed than can fit.

The Configure Applications utility can be used to select applications for preload and/or to determine how many applications can fit in memory at one time. This utility consists of a window with instructions, a set of “Select Application” checkboxes, a “fuel bar” style memory guage, and softkeys that help you set up your configuration.

For more information see:
“Preloading Applications” on page 187
“Virtual memory usage” on page 187
“Access to Configure Applications utility” on page 188

Preloading Applications

During operation of the analyzer, you select applications from the Mode menu. After startup of the analyzer program, the first time you select a particular application that application must be loaded into memory. Once loaded, the application stays loaded, so the next time you select it during a session, there is no delay. During runtime, if an application which is not yet loaded into memory is selected using the Mode menu or sending SCPI commands, there will be a pause while the Application is loaded. During this pause a message which says “Loading application, please wait …” is displayed.

You can use the Configure Applications utility to choose applications to “preload” at startup, to eliminate the runtime delay; if you do this, the delay will instead increase the time it takes to start up the analyzer program, but for many users this is preferable to having to wait the first time they select an application. Asking for an application to be preloaded will cause it to be loaded into the analyzer’s memory when the analyzer program starts up. Once it is loaded into memory, it cannot be unloaded without exiting and restarting the analyzer program.

Virtual memory usage

There are more applications available for the X-Series than can fit into memory at any one time, so the Configure Applications utility includes a memory tracker that serves two purposes:

It will not let you preload more applications than will fit into memory at once.

You can determine how many of your favorite applications can reside in memory at one time.

The utility provides a graphical representation of the amount of memory (note that the memory in question here is Virtual memory and is a limitation imposed by the oprating system, not by the amount of physical memory you have in your analyzer). You select applications to preload by checking the boxes on the left. Checked applications preload at startup. The colored fuel bar indicates the total memory required when all the checked applications are loaded (either preloaded or selected during runtime).

Here is what the fuel bar colors mean:

RED: the applications you have selected cannot all fit into the analyzer's memory. You must deselect applications until the fuel bar turns yellow.

YELLOW: the applications you have selected can all fit into the analyzer's memory, but there is less than 10% of the memory left, probably not enough to load any other applications, either via preload or by selecting a Mode while the analyzer is running..

GREEN: The indicator is green when <90% of the memory limit is consumed. This means the applications you have selected can all fit into the analyzer's memory with room to spare. You will likely be able to load one or more other applications without running out of memory.

Access to Configure Applications utility

You may, at any time, manually call up the Configure Applications utility by pressing **System, Power On, Configure Applications**, to find a configuration that works best for you, and then restart the analyzer program.

The utility may also be called if, during operation of the analyzer, you attempt to load more applications than can fit in memory at once.

A version of the utility also runs the first time you power up the analyzer after purchasing it from Agilent. In this case the utility automatically configures preloads so that as many licensed applications as possible are preloaded while keeping the total estimated virtual memory usage below the limit. This auto-configuration only takes place at the very first run, and after analyzer software upgrades.

Key Path	**System, Power On**
Initial S/W Revision	A.02.00

Select All

Marks all applications in the selection list. This allows you to enable all applications licensed on the instrument for pre-loading, or is a convenience for selecting all applications in one operation and then letting you deselect individual applications.

Key Path	**System, Power On, Configure Applications**
Initial S/W Revision	A.02.00

Deselect All

Clears the marks from all applications in the selection list, with the exception of the Power On application. The Power On application cannot be eliminated from the pre-load list.

Key Path	**System, Power On, Configure Applications**
Initial S/W Revision	A.02.00

Move Up

The application list is the order in which applications appear in the Mode Menu. This key enables you to shift the selected application up in the list, thus moving the selected application earlier in the Mode

Menu.

Key Path	**System, Power On, Configure Applications**
Initial S/W Revision	A.02.00

Move Down

The application list is the order in which applications appear in the Mode Menu. This key enables you to shift the selected application down in the list, thus moving the selected application later in the Mode Menu.

Key Path	**System, Power On, Configure Applications**
Initial S/W Revision	A.02.00

Select/Deselect

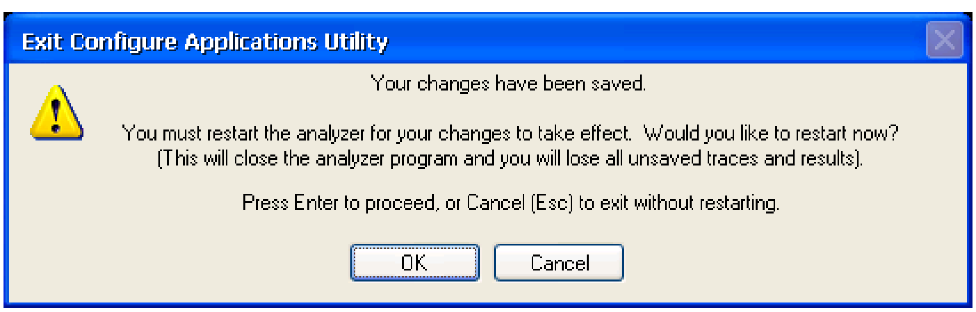
Toggles the currently highlighted application in the list.

Key Path	**System, Power On, Configure Applications**
Initial S/W Revision	A.02.00

Save Changes and Exit

Applies the configuration of the applications list. The marked applications will be pre-loaded in memory the next time the instrument application is started, and the order of the applications in the list will be the order of the applications in the Mode Menu.

After saving your changes, the analyzer asks you if you would like it to restart so that your changes can take effect (see dialog box, below). If you choose not to restart, no memory will be released until the next time you shut down and restart the analyzer.



Key Path	**System, Power On, Configure Applications**
Notes	The softkey will be grayed-out when the virtual memory of the selected applications exceeds 100% of the limit.
Remote Command	`:SYSTem:PUP:PROCess`
Example	:SYST:PUP:PROC ! This is the SCPI command for restarting the analyzer. You must Wait after this command for the instrument application to restart

Notes	You cannot use *WAI or *OPC? to synchronize operation after a restart. This command stops and restarts the instrument application, thus the SCPI operation is terminated and restarted. A remote program must use fixed wait time to resume sending commands to the instrument. The wait time will be dependent upon which applications are pre-loaded.
Initial S/W Revision	A.02.00
Modified at S/W Revision	A.04.00

Exit Without Saving

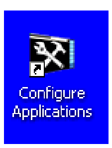
Pressing this key will exit the Configure Applications utility without saving your changes.

Key Path	**System, Power On, Configure Applications**
Initial S/W Revision	A.02.00
Modified at S/W Revision	A.04.00

Configure Applications - Instrument boot-up

At start-up of the analyzer programa dialog box similar to the one under the **System, Power On, Configure Applications** key will be displayed allowing you to choose which licensed applications are to be loaded. This dialog will only be displayed if the memory required to pre-load all of the licensed applications exceeds the Virtual Memory available.

Configure Applications - Windows desktop

The Configure Applications Utility may be run from the Windows Desktop. The utility is launched by double-clicking the 

icon on the desktop, which brings-up a dialog box similar to the one under the **System, Power On, Configure Applications** key, allowing you to choose which licensed applications are to be loaded whne the analyzer program starts up. This dialog box has mouse buttons on it which do the job that the softkeys normally do in the **System, Power On, Configure Applications** menu.

Configure Applications - Remote Commands

The following topics provide details on the using remote commands to configure the list of applications want to load into the instrument memory or query the Virtual Memory utilization for your applications.

- "Configuration list (Remote Command Only)" on page 191
- "Configuration Memory Available (Remote Command Only)" on page 191
- "Configuration Memory Total (Remote command Only)" on page 191
- "Configuration Memory Used (Remote Command Only)" on page 191
- "Configuration Application Memory (Remote Command Only)" on page 192

Configuration list (Remote Command Only)

This remote command is used to set or query the list of applications to be loaded in-memory.

Remote Command:	`:SYSTem:PON:APPLication:LLISt <string of INSTrument:SELect names>` `:SYSTem:PON:APPLication:LLISt?`
Example:	:SYST:PON:APPL:LLIS "SA,BASIC,WCDMA"
Notes:	<string of INSTrument:SELect names> are from the enums of the :INSTrument:SELect command. The order of the <INSTrument:SELect names> is the order in which the applications are loaded into memory, and the order in which they appear in the Mode Menu. Error –225 "Out of Memory" is reported when more applications are listed than can reside in Virtual Memory. When this occurs, the existing applications load list is unchanged.
Preset:	Not affected by Preset
State Saved:	Not saved in state
Initial S/W Revision:	A.02.00

Configuration Memory Available (Remote Command Only)

This remote command is used to query the amount of Virtual Memory remaining.

Remote Command:	`:SYSTem:PON:APPLication:VMEMory[:AVAilable]?`
Example:	:SYST:PON:APPL:VMEM?
Preset:	Not affected by Preset
Initial S/W Revision:	A.02.00

Configuration Memory Total (Remote command Only)

This remote command is used to query the limit of Virtual Memory allowed for applications.

Remote Command:	`:SYSTem:PON:APPLication:VMEMory:TOTal?`
Example:	:SYST:PON:APPL:VMEM:TOT?
Preset:	Not affected by Preset
Initial S/W Revision:	A.02.00

Configuration Memory Used (Remote Command Only)

This remote command is a query of the amount of Virtual Memory used by all measurement applications.

Remote Command:	`:SYSTem:PON:APPLication:VMEMory:USED?`
Example:	:SYST:PON:APPL:VMEM:USED?
Preset:	Not affected by Preset
Initial S/W Revision:	A.02.00

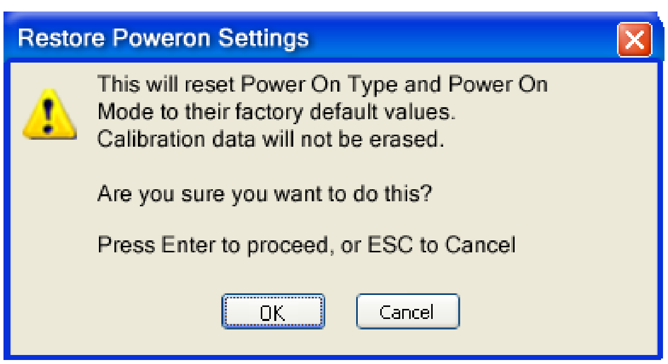
Configuration Application Memory (Remote Command Only)

This remote command is used to query the amount of Virtual Memory a particular application consumes.

Remote Command:	`:SYSTem:PON:APPLication:VMEMory:USED:NAME? <INSTrument:SELect name>`
Example:	:SYST:PON:APPL:VMEM:USED:NAME? CDMA2K
Notes:	<INSTrument:SELect name> is from the enums of the :INSTrument:SELect command in Meas Common section 13.3 Value returned will be 0 (zero) if the name provided is invalid.
Preset:	Not affected by Preset
Initial S/W Revision:	A.01.70 or later

Restore Power On Defaults

This selection causes the Power On Type and Power On Application settings to be a reset to their default values. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch. The Power On key, under the Restore System Defaults menu, causes the same action.



If you press any key other than OK or Enter, it is construed as a Cancel, because the only path that will actually cause the reset to be executed is through OK or Enter.

Key Path	**System, Power On**
Example	:SYST:DEF PON

Initial S/W Revision	Prior to A.02.00

Alignments

The Alignments Menu controls and displays the automatic alignment of the instrument, and provides the ability to restore the default alignment values.

The current setting of the alignment system is displayed in the system Settings Panel along the top of the display, including a warning icon for conditions that may cause specifications to be impacted.

Key Path	**System**
Initial S/W Revision	Prior to A.02.00

Auto Align

Configures the method for which the automatic background alignment is run.

Automatic background alignments are run periodically between measurement acquisitions. The instrument's software determines when alignments are to be performed to maintain warranted operation. The recommended setting for Auto Align is Normal.

An Auto Align execution cannot be aborted with the Cancel (ESC) key. To interrupt an Auto Align execution, select **Auto Align Off**.

Key Path	**System, Alignments**
Mode	All
Remote Command	`:CALibration:AUTO ON|PARTial|OFF` `:CALibration:AUTO?`
Example	:CAL:AUTO ON
Notes	While Auto Align is executing, bit 0 of Status Operation register is set.
Couplings	Auto Align is set to Off if Restore Align Data is invoked.
Preset	ON
Preset	This is unaffected by Preset but is set to ON upon a "Restore System Defaults->Align".
State Saved	No
Status Bits/OPC dependencies	When Auto Align is executing, bit 0 in the Status Operational register is set.
Initial S/W Revision	Prior to A.02.00

Normal

Auto Align, Normal turns on the automatic alignment of all measurement systems. The Auto Align, Normal selection maintains the instrument in warranted operation across varying temperature and over time.

If the condition “Align Now, All required” is set, transition to Auto Align, Normal will perform the required alignments and clear the “Align Now, All required” condition and then continue with further alignments as required to maintain the instrument adequately aligned for warranted operation.

When **Auto Align**, **Normal** is selected the Auto Align Off time is set to zero.

When **Auto Align**, **Normal** is selected the Settings Panel indicates ALIGN AUTO.

Key Path	**System, Alignments, Auto Align**
Mode	All
Example	:CAL:AUTO ON
Notes	Alignment processing as a result of the transition to Normal will be executed sequentially. Thus, *OPC? or *WAI following CAL:AUTO ON will return when the alignment processing is complete. The presence of an external signal may interfere with the RF portion of the alignment. If so, the Error Condition “Align skipped: 50 MHz interference” or “Align skipped: 4.8 GHz interference” is reported, and bit 11 is set in the Status Questionable Calibration register. After the interfering signal is removed, subsequent alignment of the RF will clear the condition, and clear bit 11 in the Status Questionable Calibration register.
Readback Text	Normal
Status Bits/OPC dependencies	An interfering user signal may prevent automatic alignment of the RF subsystem. If this occurs, the Error Condition “Align skipped: 50 MHz interference” or “Align skipped: 4.8 GHz interference” is reported, the Status Questionable Calibration bit 11 is set, and the alignment proceeds. When a subsequent alignment of the RF subsystem succeeds, either by the next cycle of automatic alignment or from an **Align Now**, **RF**, the Error Condition and Status Questionable Calibration bit 11 are cleared.
Initial S/W Revision	Prior to A.02.00

Partial

Auto Align, **Partial** disables the full automatic alignment and the maintenance of warranted operation for the benefit of improved measurement throughput. Accuracy is retained for the Resolution Bandwidth filters and the IF Passband which is critical to FFT accuracy, demodulation, and many measurement applications. With Auto Align set to **Partial**, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The **Auto Align**, **Alert** mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the **Align All**, **Now** operation. Another is to return the **Auto Align** selection to **Normal**.

Auto Align, **Partial** is recommended for measurements where the throughput is so important that a few percent of improvement is more valued than an increase in the accuracy errors of a few tenths of a decibel. One good application of **Auto Align**, **Partial** would be an automated environment where the alignments can be called during overhead time when the device-under-test is exchanged.

When **Auto Align**, **Partial** is selected the elapsed time counter begins for Auto Align Off time.

When **Auto Align**, **Partial** is selected the Settings Panel indicates ALIGN PARTIAL with a warning icon. The warning icon is to inform the operator that they are responsible for maintaining the warranted operation of the instrument

Key Path	**System, Alignments, Auto Align**
Mode	All
Example	:CAL:AUTO PART
Notes	Auto Align Partial begins the elapsed time counter for Auto Align Off time.
Readback Text	Partial
Initial S/W Revision	Prior to A.02.00

Off

Auto Align, **Off** disables automatic alignment and the maintenance of warranted operation, for the benefit of maximum measurement throughput. With Auto Align set to **Off**, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The **Auto Align**, **Alert** mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the **Align All**, **Now** operation. Another is to return the **Auto Align** selection to **Normal**.

The **Auto Align**, **Off** setting is rarely the best choice, because **Partial** gives almost the same improvement in throughput while maintaining the warranted performance for a much longer time. The **Off** choice is intended for unusual circumstances such as the measurement of radar pulses where you might like the revisit time to be as consistent as possible.

When **Auto Align**, **Off** is selected the Auto Align Off time is initialized and the elapsed time counter begins.

When **Auto Align**, **Off** is selected the Settings Panel indicates ALIGN OFF with a warning icon. The warning icon is to inform the operator that they are responsible for maintaining the warranted operation of the instrument:

Key Path	**System, Alignments, Auto Align**
Mode	All
Example	:CAL:AUTO OFF
Notes	Auto Align Off begins the elapsed time counter for Auto Align Off time.
Couplings	Auto Align is set to Off if Restore Align Data is invoked.
Readback Text	Off
Initial S/W Revision	Prior to A.02.00

All but RF

Auto Align, **All but RF**, configures automatic alignment to include or exclude the RF subsystem. (Eliminating the automatic alignment of the RF subsystem prevents the input impedance from changing. The normal input impedance of 50 ohms can change to an open circuit when alignments are being used. Some devices under test do not behave acceptably under such circumstances, for example by showing instability.) When **Auto Align**, **All but RF ON** is selected, the operator is responsible for performing an **Align Now**, **RF** when RF-related alignments expire. The **Auto Align**, **Alert** mechanism will notify the operator to perform an **Align Now**, **All** when the combination of time and temperature variation is exceeded.

When **Auto Align**, **All but RF ON** is selected the Settings Panel indicates ALIGN AUTO/NO RF with a warning icon (warning icon is intended to inform the operator they are responsible for the maintaining the RF alignment of the instrument):

Key Path	**System, Alignments, Auto Align**
Mode	All
Remote Command	`:CALibration:AUTO:MODE ALL|NRF` `:CALibration:AUTO:MODE?`
Example	:CAL:AUTO:MODE NRF
Preset	ALL
Preset	This is unaffected by Preset but is set to ALL on a “Restore System Defaults->Align”.
State Saved	No
Readback Text	RF or NRF
Initial S/W Revision	Prior to A.02.00

Alert

The instrument will signal an Alert when conditions exist such that you will need to perform a full alignment (for example, **Align Now**, **All**). The Alert can be configured in one of four settings; **Time & Temperature**, **24 hours**, **7 days**, or **None**. A confirmation is required when a selection other than **Time & Temperature** is chosen. This prevents accidental deactivation of alerts.

With **Auto Align** set to **Normal**, the configuration of **Alert** is not relevant because the instrument’s software maintains the instrument in warranted operation.

Key Path	**System, Alignments, Auto Align**
Mode	All
Remote Command	`:CALibration:AUTO:ALERt TTEMperature|DAY|WEEK|NONE` `:CALibration:AUTO:ALERt?`
Example	:CAL:AUTO:ALER TTEM
Notes	The alert that alignment is needed is the setting of bit 14 in the Status Questionable Calibration register.
Preset	TTEMperature
Preset	This is unaffected by Preset but is set to TTEMperature on a “Restore System Defaults->Align”.

State Saved	No
Status Bits/OPC dependencies	The alert is the Error Condition "Align Now, All required" and bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

Time & Temperature

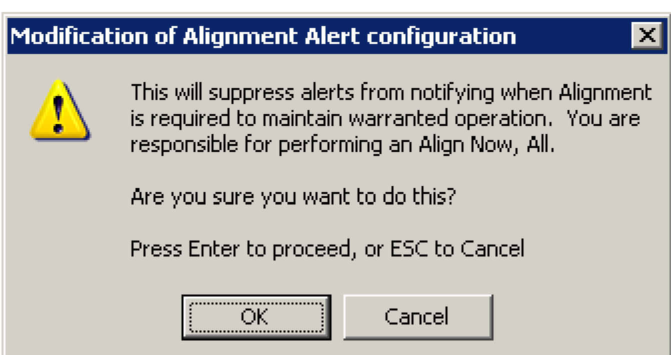
With Auto Align Alert set to **Time & Temperature** the instrument will signal an alert when alignments expire due to the combination of the passage of time and changes in temperature. The alert is the Error Condition "Align Now, All required". If this choice for Alert is selected, the absence of an alert means that the analyzer alignment is sufficiently up-to-date to maintain warranted accuracy.

Key Path	**System, Alignments, Auto Align, Alert**
Mode	All
Example	:CAL:AUTO:ALER TTEM
Readback Text	Time & Temp
Status Bits/OPC dependencies	Bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

24 hours

With Auto Align Alert set to **24 Hours** the instrument will signal an alert after a time span of 24 hours since the last successful full alignment (for example, **Align Now**, **All** or completion of a full Auto Align). You may choose this selection in an environment where the temperature is stable on a daily basis at a small risk of accuracy errors in excess of the warranted specifications. The alert is the Error Condition "Align Now, All required".

For front-panel operation , confirmation is required to transition into this setting of Alert. The confirmation dialog is:



No confirmation is required when Alert is configured through a remote command.

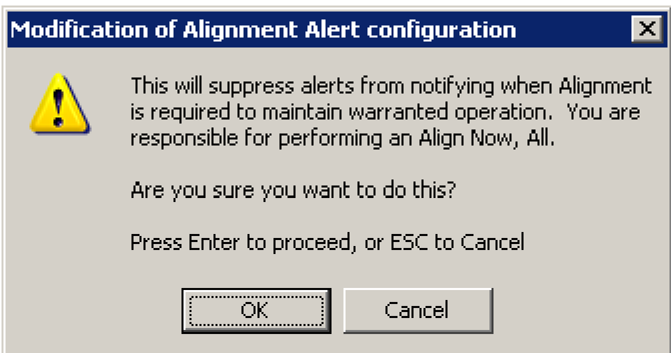
Key Path	**System, Alignments, Auto Align, Alert**
Mode	All
Example	:CAL:AUTO:ALER DAY

Readback Text	24 hours
Status Bits/OPC dependencies	Bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

7 days

With Auto Align Alert is set to **7 days** the instrument will signal an alert after a time span of 168 hours since the last successful full alignment (for example, **Align Now**, **All** or completion of a full Auto Align). You may choose this selection in an environment where the temperature is stable on a weekly basis, at a modest risk of accuracy degradations in excess of warranted performance. The alert is the Error Condition “Align Now, All required”.

For front panel operation, confirmation is required for the customer to transition into this setting of Alert. The confirmation dialog is:



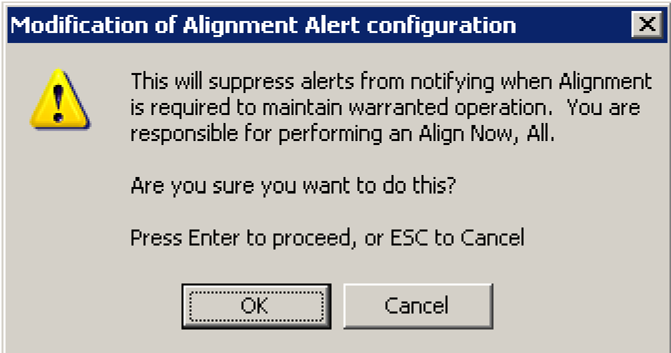
No confirmation is required when Alert is configured through a remote command.

Key Path	**System, Alignments, Auto Align, Alert**
Mode	All
Example	:CAL:AUTO:ALER WEEK
Readback Text	7 days
Status Bits/OPC dependencies	Bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

None

With Auto Align Alert set to **None** the instrument will not signal an alert. This is provided for rare occasions where you are making a long measurement which cannot tolerate Auto Align interruptions, and must have the ability to capture a screen image at the end of the measurement without an alert posted to the display. Agilent does not recommends using this selection in any other circumstances, because of the risk of accuracy performance drifting well beyond expected levels without the operator being informed.

For front panel operation, confirmation is required to transition into this setting of Alert. The confirmation dialog is:



No confirmation is required when Alert is configured through a remote command.

Key Path	**System, Alignments, Auto Align, Alert**
Mode	All
Example	:CAL:AUTO:ALER NONE
Initial S/W Revision	Prior to A.02.00

Align Now

Accesses alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

Key Path	**System, Alignments**
Initial S/W Revision	Prior to A.02.00

All

Immediately executes an alignment of all subsystems. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

If an interfering user signal is present at the RF Input, the alignment is performed on all subsystems except the RF. After completion, the Error Condition “Align skipped: 50 MHz interference” or “Align skipped: 4.8 GHz interference” is set. In addition the Error Condition “Align Now, RF required” is set, and bits 11 and 12 are set in the Status Questionable Calibration register.

The query form of the remote commands (:CALibration[:ALL]? or *CAL?) invokes the alignment of all subsystems and returns a success or failure value. An interfering user signal is not grounds for failure; if the alignment was able to succeed on all portions but unable to align the RF because of an interfering signal, the resultant will be the success value.

Successful completion of **Align Now**, **All** will clear the “Align Now, All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. It will also begin the elapsed time counter for Last Align Now, All Time, and capture the Last Align Now, All Temperature.

If the Align RF subsystem succeeded in aligning (no interfering signal present), the elapsed time counter begins for Last Align Now, RF Time, and the temperature is captured for the Last Align Now, RF

Temperature. In addition the Error Conditions “Align skipped: 50 MHz interference” and “Align skipped: 4.8 GHz interference” are cleared, the Error Condition “Align Now, RF required” is cleared, and bits 11 and 12 are cleared in the Status Questionable Calibration register

Align Now, **All** can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. When this occurs the Error Condition “Align Now, All required” is set, and bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

In many cases, you might find it more convenient to change alignments to **Normal**, instead of executing **Align Now**, **All**. When the Auto Align process transitions to **Normal**, the analyzer will immediately start to update only the alignments that have expired, thus efficiently restoring the alignment process.

Key Path	**System, Alignments, Align Now**
Mode	All
Remote Command	`:CALibration[:ALL]` `:CALibration[:ALL]?`
Example	:CAL
Notes	:CALibration[:ALL]? returns 0 if successful :CALibration[:ALL]? returns 1 if failed :CALibration[:ALL]? is the same as *CAL? While Align Now, All is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register. This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the :ABORt command. Successful completion will clear bit 14 in the Status Questionable Calibration register. An interfering user signal is not grounds for failure of Align Now, All. However, bits 11 and 12 are set in the Status Questionable Calibration register to indicate Align Now, RF is required. An interfering user supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed.
Couplings	Initializes the time for the Last Align Now, All Time. Records the temperature for the Last Align Now, All Temperature. If Align RF component succeeded, initializes the time for the Last Align Now, RF Time. If Align RF component succeeded, records the temperature for the Last Align Now, RF Temperature.
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register.

Initial S/W Revision	Prior to A.02.00

Mode	All
Remote Command	`*CAL?`
Example	*CAL?
Notes	*CAL? returns 0 if successful *CAL? returns 1 if failed :CALibration[:ALL]? is the same as *CAL? See additional remarks described with :CALibration[:ALL]? Everything about :CALibration[:ALL]? is synonymous with *CAL? including all conditions, status register bits, and couplings
Initial S/W Revision	Prior to A.02.00

All but RF

Immediately executes an alignment of all subsystems except the RF subsystem. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key). This can be used to align portions of the instrument that are not impacted by an interfering user input signal.

This operation might be chosen instead of **All** if you do not want the device under test to experience a large change in input impedance, such as a temporary open circuit at the analyzer input.

The query form of the remote commands (:CALibration:NRF?) will invoke the alignment and return a success or failure value.

Successful completion of **Align Now**, **All but RF** will clear the “Align Now, All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. If “Align Now, All required” was in effect prior to executing the All but RF, the Error Condition “Align Now, RF required” is asserted and bit 12 in the Status Questionable Calibration register is set. It will also begin the elapsed time counter for Last Align Now, All Time, and capture the Last Align Now, All Temperature.

Align Now, **All but RF** can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. When this occurs the Error Condition “Align Now, All required” is set, and bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be used for an individual subsystem, but not a full new set of data for all subsystems.

Key Path	**System, Alignments, Align Now**
Mode	All
Remote Command	`:CALibration:NRF` `:CALibration:NRF?`
Example	:CAL:NRF

Notes	:CALibration:NRF? returns 0 if successful :CALibration:NRF? returns 1 if failed While Align Now, All but RF is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register. This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the :ABORt command. Successful completion will clear bit 14 in the Status Questionable Calibration register and set bit 12 if invoked with “Align Now, All required”.
Couplings	Initializes the time for the Last Align Now, All Time. Records the temperature for the Last Align Now, All Temperature.
Status Bits/OPC dependencies	Bits 12 or 14 may be set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

RF

Immediately executes an alignment of the RF subsystem. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

This operation might be desirable if the alignments had been set to not include RF alignments, or if previous RF alignments could not complete because of interference which has since been removed.

If an interfering user signal is present at the RF Input, the alignment will terminate and raise the Error Condition “Align skipped: 50 MHz interference” or “Align skipped: 4.8 GHz interference”, and Error Condition “Align Now, RF required”. In addition, bits 11 and 12 will be set in the Status Questionable Calibration register.

The query form of the remote commands (:CALibration:RF?) will invoke the alignment of the RF subsystem and return a success or failure value. An interfering user signal is grounds for failure.

A failure encountered during alignment will set the Error Condition “Align RF failed” and set bit 3 in the Status Questionable Calibration register.

Successful completion of **Align Now**, **RF** clears the Error Conditions “Align skipped: 50 MHz interference” and “Align skipped: 4800 MHz interference” and the Error Conditions “Align RF failed” and “Align Now, RF required”, and clears bits 3, 11, and 12 in the Status Questionable Calibration register. It will also begin the elapsed time counter for Last Align Now, RF Time, and capture the Last Align Now, RF Temperature.

Align Now, **RF** can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. When this occurs, the Error Condition “Align Now, RF required” is set, and bit 12 is set in the Status Questionable Condition register. None of the new alignment data is used.

Key Path	**System, Alignments, Align Now**
Mode	All

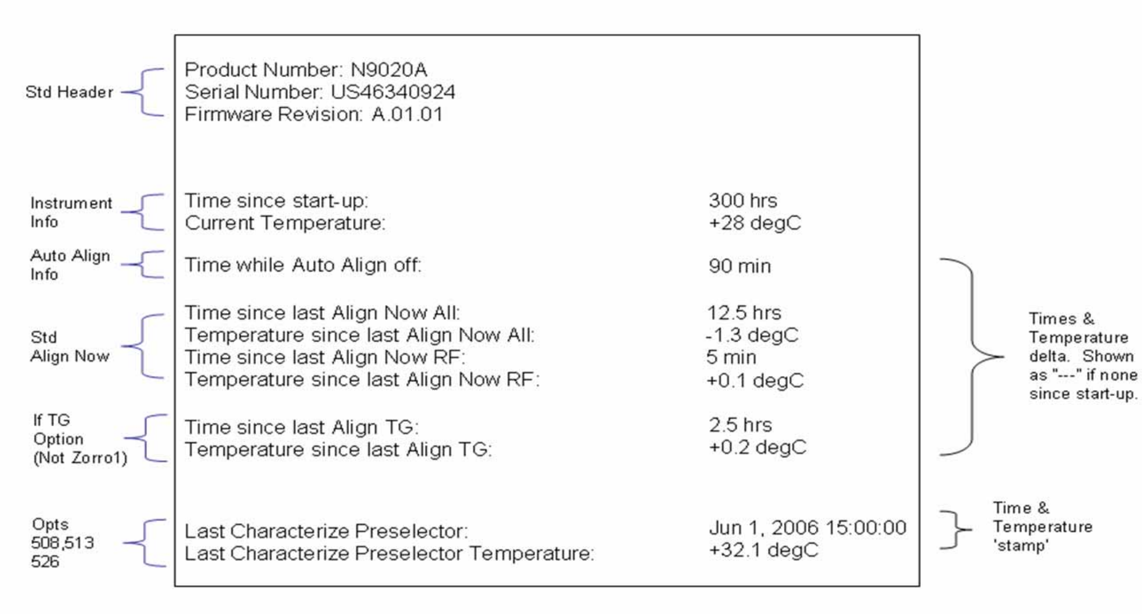
Remote Command	`:CALibration:RF` `:CALibration:RF?`
Example	:CAL:RF
Notes	:CALibration:RF? returns 0 if successful :CALibration:RF? returns 1 if failed (including interfering user signal) While Align Now, RF is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register. This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the :ABORt command. Successful completion will clear bits 3, 11, and 12 in the Status Questionable Calibration register. A failure encountered during alignment will set the Error Condition "Align RF failed" and set bit 3 in the Status Questionable Calibration register. An interfering user signal will result in bits 11 and 12 to be set in the Status Questionable Calibration register to indicate Align Now, RF is required. An interfering user supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed.
Couplings	Initializes the time for the Last Align Now, RF Time. Records the temperature for the Last Align Now, RF Temperature.
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

Show Alignment Statistics

Shows alignment information you can use to ensure that the instrument is operating in a specific manner. The Show Alignment Statistics screen is where you can view time and temperature information.

Values which are displayed are only updated when the Show Alignment Statistics screen is invoked, they are not updated while the Show Alignment Statistics screen is being displayed. The remote commands which access this information obtain current values.

An example of the Show Alignment Statistics screen would be similar to:



A successful Align Now, RF will set the Last Align RF temperature to the current temperature, and reset the Last Align RF time. A successful Align Now, All or Align Now, All but RF will set the Last Align Now All temperature to the current temperature, and reset the Last Align Now All time. A successful Align Now, All will also reset the Last Align RF items if the RF portion of the Align Now succeeded.

Key Path	**System, Alignments**
Mode	All
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed.
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:SYSTem:PON:TIME?`
Example	:SYST:PON:TIME?
Notes	Value is the time since the most recent start-up in seconds.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:CALibration:TEMPerature:CURRent?`

Example	:CAL:TEMP:CURR?
Notes	Value is in degrees Centigrade. Value is invalid if using default alignment data (Align Now, All required)
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:CALibration:TIME:LALL?`
Example	:CAL:TIME:LALL?
Notes	Value is the elapsed time, in seconds, since the last successful Align Now, All or Align Now, All but RF was executed.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:CALibration:TEMPerature:LALL?`
Example	:CAL:TEMP:LALL?
Notes	Value is in degrees Centigrade at which the last successful Align Now, All or Align Now, All but RF was executed.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:CALibration:TIME:LRF?`
Example	:CAL:TIME:LRF?
Notes	Value is the elapsed time, in seconds, since the last successful Align Now, RF was executed, either individually or as a component of Align Now, All.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**

Mode	All
Remote Command	`:CALibration:TEMPerature:LRF?`
Example	:CAL:TEMP:LRF?
Notes	Value is in degrees Centigrade at which the last successful Align Now, RF was executed, either individually or as a component of Align Now, All.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:CALibration:TIME:LPReselector?`
Example	:CAL:TIME:LPR?
Notes	Value is date and time the last successful Characterize Preselector was executed. The date is separated from the time by a space character. Returns “” if no Characterize Preselector has ever been performed on the instrument.
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query will yield an error.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:CALibration:TEMPerature:LPReselector?`
Example	:CAL:TEMP:LPR?
Notes	Value is in degrees Centigrade at which the last successful Characterize Preselector was executed.
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query will yield an error.
State Saved	No
Initial S/W Revision	Prior to A.02.00

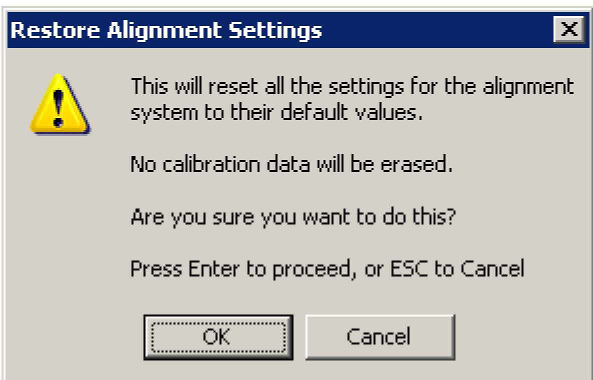
Key Path	**Visual annotation in the Show Alignment Statistics screen**
Mode	All
Remote Command	`:CALibration:AUTO:TIME:OFF?`
Example	:CAL:AUTO:TIME:OFF?

Notes	Value is the elapsed time, in seconds, since Auto Align has been set to Off or Off with Alert. The value is 0 if Auto Align is ALL or NORF.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Restore Align Defaults

Initializes the alignment user interface settings, not alignment data, to the factory default values. Align Now, All must be executed if the value of the Timebase DAC results in a change.

For front panel operation, you are prompted to confirm action before setting the alignment parameters to factory defaults:



The parameters affected are:

Parameter	**Setting**
Timebase DAC	Calibrated
Timebase DAC setting	Calibrated value
Auto Align State	Normal (if the instrument is not operating with default alignment data, Off otherwise)
Auto Align All but RF	Off
Auto Align Alert	Time & Temperature

Key Path	**System, Alignments**
Mode	All
Example	:SYST:DEF ALIG
Notes	Alignment processing that results as the transition to Auto Alignment Normal will be executed sequentially; thus *OPC? or *WAI will wait until the alignment processing is complete.
Initial S/W Revision	Prior to A.02.00

Backup and Restore Alignment Data

Alignment data for the instrument resides on the hard drive in a database. Agilent uses high quality hard drives; however it is highly recommended the alignment data be backed-up to storage outside of the instrument. Additionally, for customers who use multiple CPU Assemblies or multiple disk drives, the alignment that pertains to the instrument must be transferred to the resident hard drive after a CPU or hard drive is replaced. This utility facilitates backing-up and restoring the alignment data.

NOTE This utility allows the operator to navigate to any location of the Windows file system. It is intended that the operator use a USB memory device or Mapped Network Drive to backup the alignment data to storage outside of the instrument.

Backup or Restore Align Data…

Opens the utility for backing-up or restoring the alignment data.

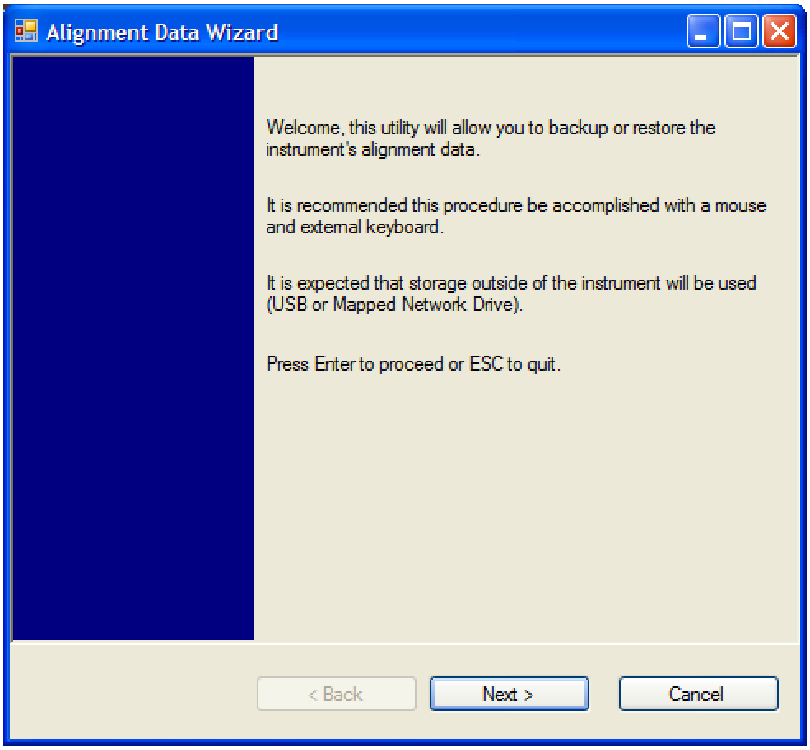
Key Path	**System, Alignments**
Initial S/W Revision	A.02.00

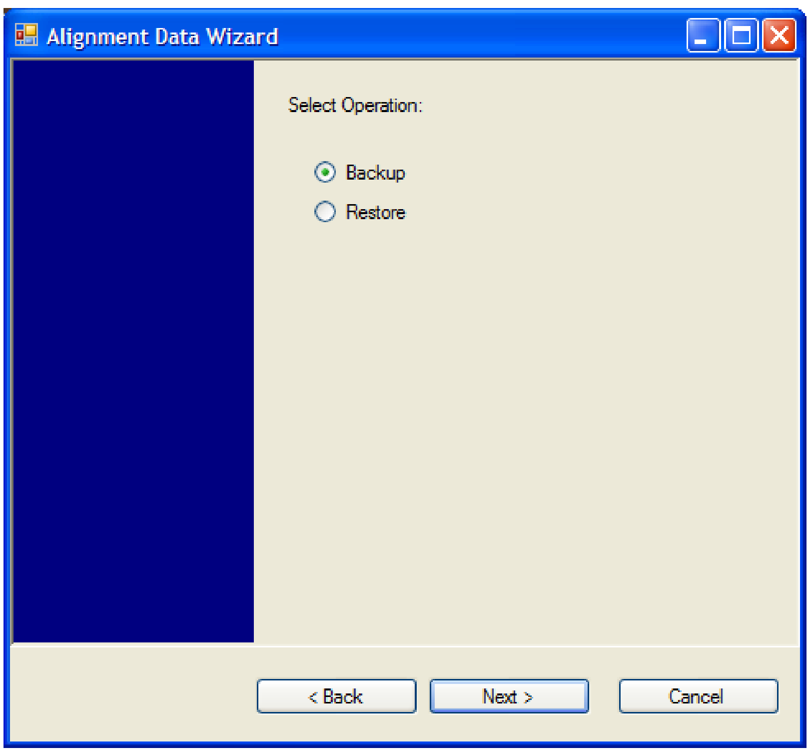
Key Path	**System, Alignments**
Mode	All
Remote Command	`:CALibration:DATA:DEFault`
Example	:CAL:DATA:DEF
Couplings	Sets Auto Align to Off. Sets bit 14 in the Status Questionable Calibration register. The Error Condition “Align Now, All required” is set.
Initial S/W Revision	Prior to A.02.00

Alignment Data Wizard

The Backup or Restore Alignment Data wizard will guide you through the operation of backing-up or restoring the alignment data.

The following dialogue boxes operate without a mouse or external keyboard when you use the default file names.

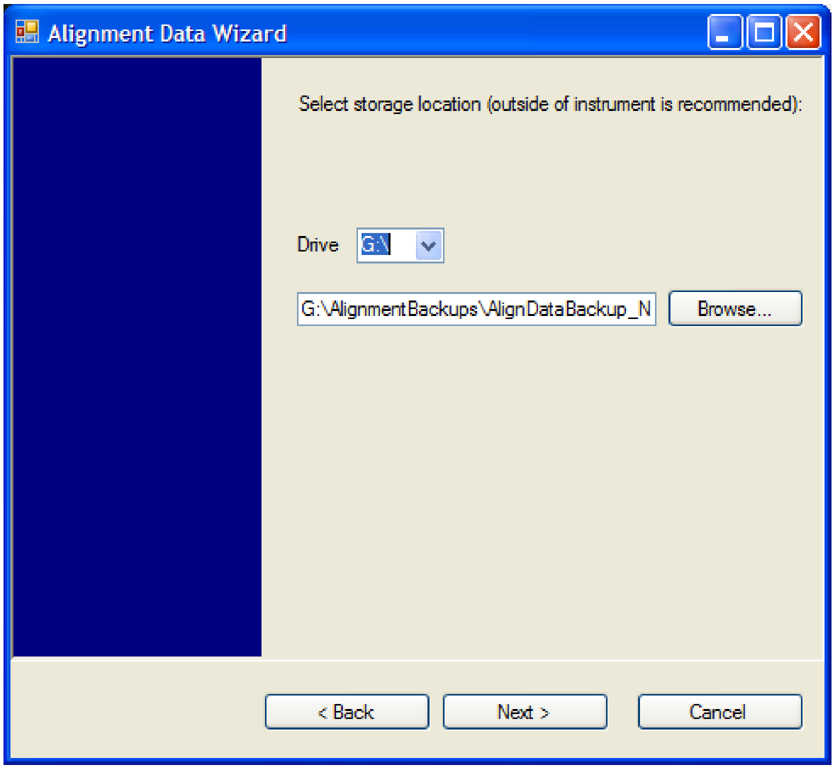




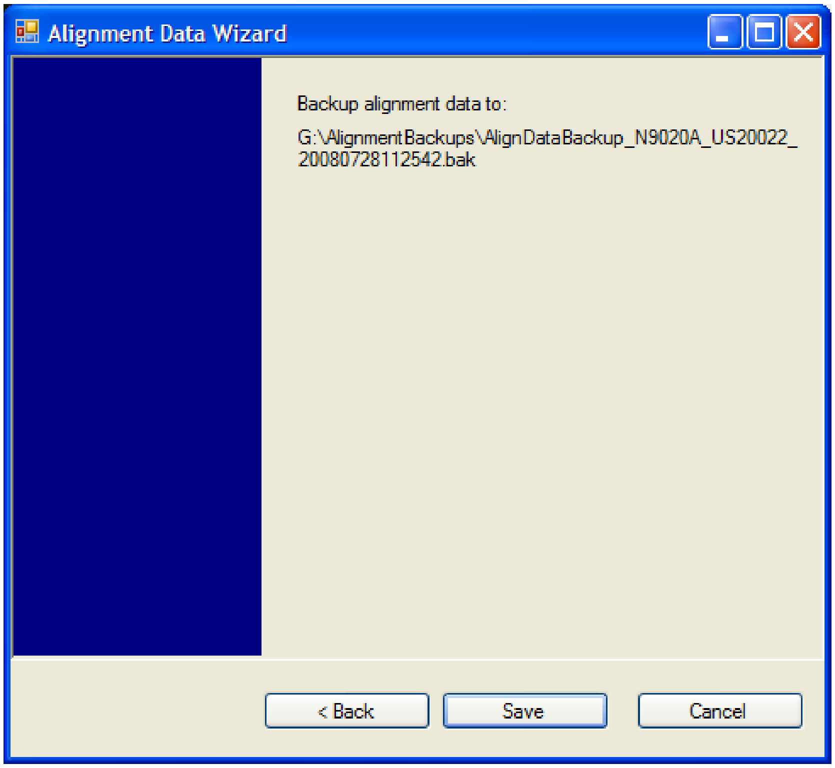
The backup screen will indicate the approximate amount of space required to contain the backup file.

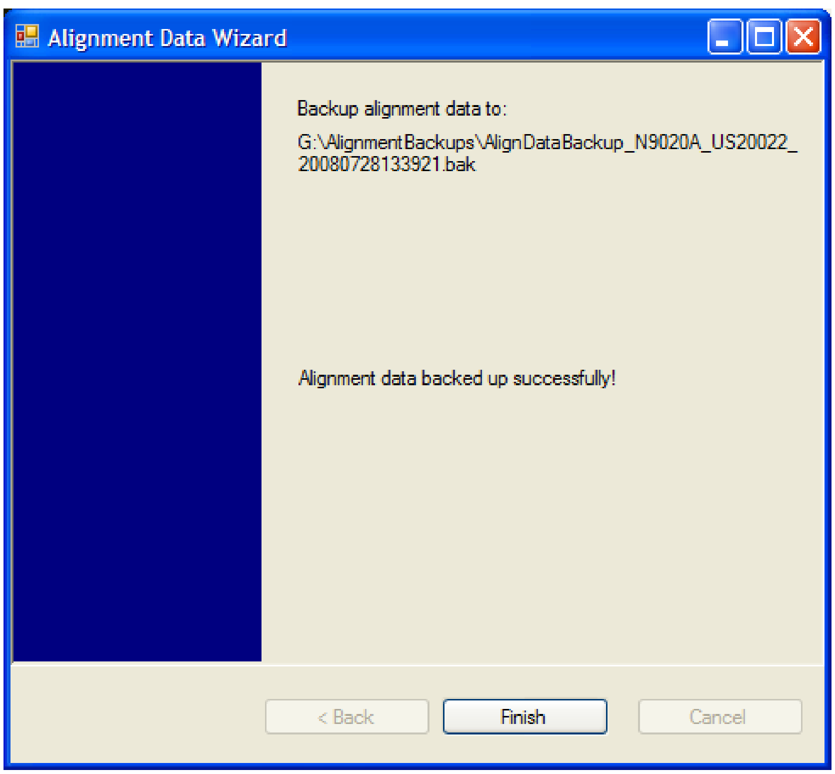
The default file name will be AlignDataBackup_<model number>_<serial number>_<date in YYYYMMDDHHMMSS>.bak.

For the N9030A the default backup location will be the internal F: drive which is a solid-state memory device located internally on the instrument.



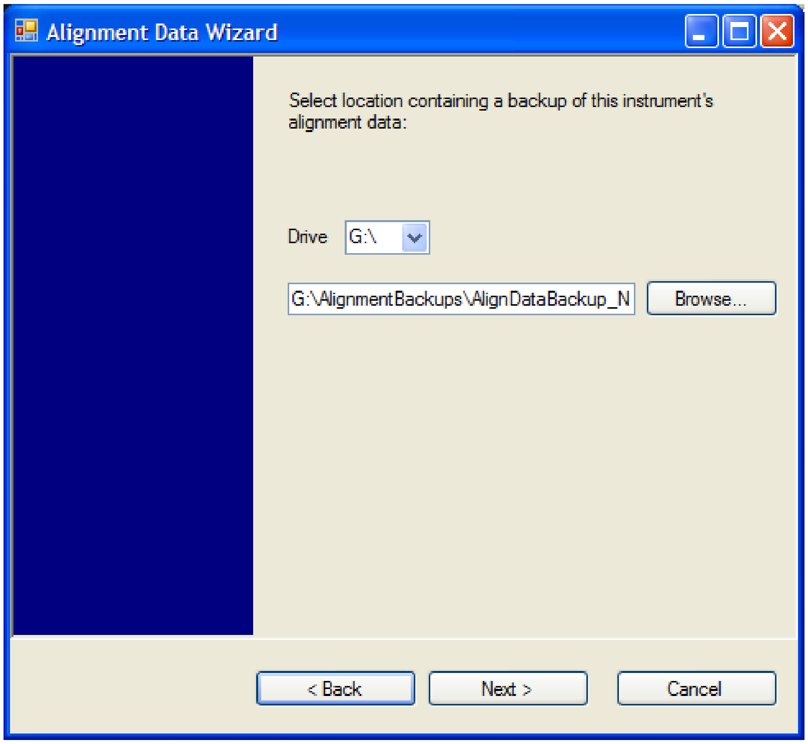
Changing the drive letter will also modify the path displayed in the box below. When this step is first loaded, the drive drop-down is populated with connected drives which provide the user with write access. If there are many unreachable network drives connected to the instrument, this step can take a few seconds. If a USB drive is present, it will be selected by default. The path defaults to the AlignmentBackups folder, and a filename will be automatically created in the form of AlignDataBackup_<model>_<serial number>_<date><time>. When the "Next >" button is pressed, the user will be prompted to create a new folder if the chosen path does not yet exist.



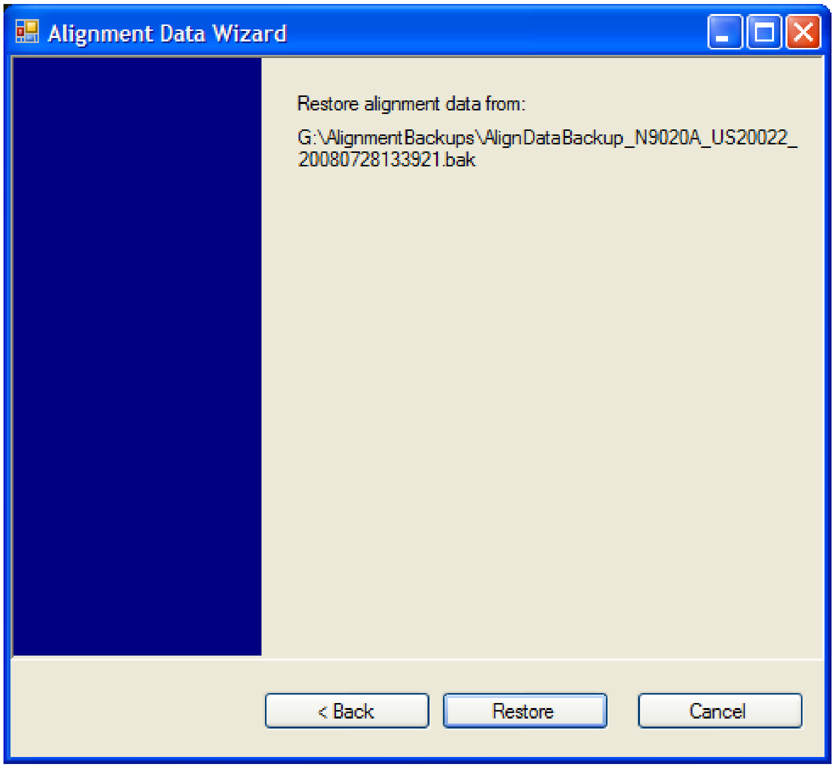


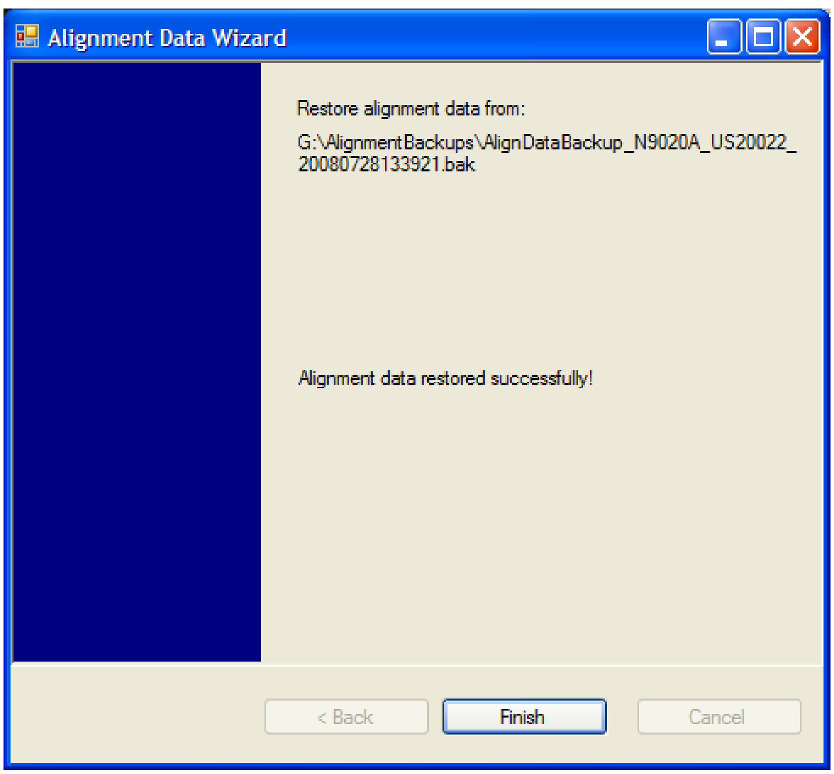
The restore operation will check the validity of the restore file using the database's built-in file validation. If the restore file is corrupt, the existing alignment data will remain in use.

For the N9030A, the default restore location will be the internal F: drive which is a solid-state memory device located internally on the instrument. The default restore file will be the most recent file that matches the default backup file name format: AlignDataBackup_N9030A_<serial number>_<date>.bak



Changing the drive letter will also modify the path displayed in the box below. When this step is first loaded, the drive drop-down is populated with connected drives which provide the user with read access. The path defaults to the AlignBackups folder. The most recent *.bak file in the folder will also be selected by default.





Perform Backup (Remote Command Only)

Invokes an alignment data backup operation to the provided Folder.

NOTE	It is recommended that the Folder provided is outside of the instrument (USB or Mapped Network Drive).

Remote Command:	`:CALibration:DATA:BACKup <filename>`
Example:	:CAL:DATA:BACK "F:\AlignDataBackup_N9020A_US00000001_2008140100.bak"
Initial S/W Revision:	A.02.00

Perform Restore (Remote Command Only)

Invokes an alignment data restore operation from the provided filename.

Remote Command:	`:CALibration:DATA:RESTore <filename>`
Example:	:CAL:DATA:REST "F:\AlignDataBackup_N9020A_US00000001_2008140100.bak "
Initial S/W Revision:	A.02.00

Advanced

Accesses alignment processes that are immediate action operations that perform operations that run until complete. Advanced alignments are performed on an irregular basis, or require additional operator interaction

Key Path	**System, Alignments**
Initial S/W Revision	Prior to A.02.00

Characterize Preselector (Only with Option 507, 508, 513, or 526)

The Preselector tuning curve drifts over temperature and time. Recognize that the **Amplitude**, **Presel Center** function adjusts the preselector for accurate amplitude measurements at an individual frequency. **Characterize Preselector** improves the amplitude accuracy by ensuring the Preselector is approximately centered at all frequencies without the use of the **Amplitude**, **Presel Center** function. **Characterize Preselector** can be useful in situations where absolute amplitude accuracy is not of utmost importance, and the throughput savings or convenience of not performing a **Presel Center** is desired. **Presel Center** is required prior to any measurement for best (and warranted) amplitude accuracy.

Agilent recommends that the **Characterize Preselector** operation be performed yearly as part of any calibration, but performing this operation every three months can be worthwhile.

Characterize Preselector immediately executes a characterization of the Preselector, which is a YIG-tuned filter (YTF). The instrument stops any measurement currently underway, performs the characterization, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

The query form of the remote commands (:CALibration:YTF?) will invoke the alignment of the YTF subsystem and return a success or failure value.

A failure encountered during alignment will set the Error Condition “Characterize YTF failed” and set bit 9 in the Status Questionable Calibration register.

Successful completion of **Advanced**, **Characterize Preselector** will clear the Error Condition “Characterize YTF failed”, and clear bit 9 in the Status Questionable Calibration register. It will also begin the elapsed time counter for Last Characterize Preselector Time, and capture the Last Characterize Preselector Temperature.

The last Characterize Preselector Time and Temperature must survive across the power cycle as this operation is performed infrequently.

Advanced, **Characterize Preselector** can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. None of the new characterization data is then used.

Remote Command	`:CALibration:YTF` `:CALibration:YTF?`
Example	:CAL:YTF
Initial S/W Revision	Prior to A.02.00
Key Path	**System, Alignments, Advanced**
Mode	All
Notes	:CALibration:YTF? returns 0 if successful :CALibration:YTF? returns 1 if failed (including interfering user signal) While Advanced, Characterize Preselector is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register. This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the :ABORt command. Successful completion will clear bit 9 in the Status Questionable Calibration register. A failure encountered during alignment will set the Error Condition “Characterize Preselector failed” and set bit 9 in the Status Questionable Calibration register. For Option 507, 508, 513, and 526 only.
Dependencies	This key does not appear in models that do not contain preselectors. In these models the SCPI command is accepted without error but no action is taken.
Couplings	Initializes the time for the Last Characterize Preselector Time. Records the temperature for the Last Characterize Preselector Temperature.

Timebase DAC

Allows control of the internal 10 MHz reference oscillator timebase. This may be used to adjust for minor frequency alignment between the signal and the internal frequency reference. This adjustment has no effect if the instrument is operating with an External Frequency Reference.

If the value of the Timebase DAC changes (by switching to Calibrated from User with User set to a different value, or in User with a new value entered) an alignment may be necessary. The alignment system will take appropriate action; which will either invoke an alignment or cause an Alert.

Key Path	**System, Alignments**
Mode	All
Remote Command	`:CALibration:FREQuency:REFerence:MODE CALibrated|USER` `:CALibration:FREQuency:REFerence:MODE?`
Example	:CAL:FREQ:REF:MODE CAL
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due. If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due.
Preset	CAL
Preset	This is unaffected by Preset but is set to CALibrated on a “Restore System Defaults->Align”.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Calibrated

Sets the Timebase DAC to the value established during factory or field calibration. The value displayed on the menu key is the calibrated value.

Key Path	**System, Alignments, Timebase DAC**
Mode	All
Example	:CAL:FREQ:REF:MODE CAL
Readback Text	[xxx] < where xxx is the calibrated value
Initial S/W Revision	Prior to A.02.00

User

Allows setting the Timebase DAC to a value other than the value established during the factory or field calibration. The value displayed on the menu key is the calibrated value.

Key Path	**System, Alignments, Timebase DAC**
Mode	All
Example	:CAL:FREQ:REF:MODE USER

Readback Text	xxx < where xxx is the Timebase DAC setting
Initial S/W Revision	Prior to A.02.00

Key Path	**System, Alignments, Timebase DAC**
Mode	All
Remote Command	`:CALibration:FREQuency:REFerence:FINE <integer>` `:CALibration:FREQuency:REFerence:FINE?`
Example	:CAL:FREQ:REF:FINE 8191
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due.
Couplings	Setting :CAL:FREQ:REF:FINE sets :CAL:FREQ:REF:MODE USER
Preset	This is unaffected by Preset but is set to the factory setting on a “Restore System Defaults->Align”.
State Saved	No
Min	0
Max	16383
Initial S/W Revision	Prior to A.02.00

Remote Command:	`:CALibration:FREQuency:REFerence:COARse <integer>` `:CALibration:FREQuency:REFerence:COARse?`
Example:	:CAL:FREQ:REF:COAR 8191
Notes:	This is an alias for CAL:FREQ:REF:FINE any change to COARse is reflected in FINE and vice-versa. See CAL:FREQ:REF:FINE for description of functionality.
Couplings:	Setting :CAL:FREQ:REF:COAR sets :CAL:FREQ:REF:MODE USER
Initial S/W Revision:	Prior to A.02.00

I/O Config

Activates a menu for identifying and changing the I/O configuration for remote control.

Key Path	**System**
Initial S/W Revision	Prior to A.02.00

GPIB

Activates a menu for configuring the GPIB I/O port.

Key Path	**System, I/O Config**
Initial S/W Revision	A.02.00

GPIB Address

Select the GPIB remote address.

Key Path	**System, I/O Config, GPIB**
Mode	All
Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess <integer>` `:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?`
Example	:SYST:COMM:GPIB:ADDR 17
Notes	Changing the Address on the GPIB port requires all further communication to use the new address.
Preset	18
Preset	This is unaffected by Preset but is set to 18 on a “Restore System Defaults->Misc”
State Saved	No
Range	0 to 30
Initial S/W Revision	Prior to A.02.00

GPIB Controller

Sets the GPIB port into controller or device mode. In the normal state, GPIB controller is disabled, which allows the analyzer to be controlled by a remote computer. When GPIB Controller is enabled, the instrument can run software applications that use the instrument's computer as a GPIB controller; controlling devices connected to the instrument's GPIB port.

NOTE When GPIB Controller is enabled, the analyzer application itself cannot be controlled over GPIB. In this case it can easily be controlled via LAN or USB. The GPIB port cannot be a controller and device at the same time. Only one controller can be active on the GPIB bus at any given time. If the analyzer is the controller, an external PC cannot be a controller.

To control the instrument from the software that is performing GPIB controller operation, you can use an internal TCP/IP connection to the analyzer application. Use the address TCPIP0::localhost::inst0::INSTR to send SCPI commands to the analyzer application.

Key Path	**System, I/O Config, GPIB**

Mode	All
Scope	Mode Global
Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle] ON|OFF|0|1` `:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]?`
Example	:SYST:COMM:GPIB:CONT ON ! Will set GPIB port to Controller
Notes	When the instrument becomes the Controller bit 0 in the Standard Event Status Register is set (and when the instrument relinquishes Controller capability bit 0 is cleared in the Standard Event Status Register).
Preset	OFF
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Misc"
State Saved	No
Range	Disabled|Enabled
Initial S/W Revision	A.02.00

Disabled

Disables the GPIB Controller capability, this is the default (or normal) setting.

Key Path	**System, I/O Config, GPIB, GPIB Controller**
Example	:SYST:COMM:GPIB:CONT OFF ! Will set GPIB port to Device
Initial S/W Revision	A.02.00

Enabled

Enables the GPIB Controller capability.

Key Path	**System, I/O Config, GPIB, GPIB Controller**
Example	:SYST:COMM:GPIB:CONT ON ! Will set GPIB port to Controller
Initial S/W Revision	A.02.00

SCPI LAN

Activates a menu for identifying and changing the SCPI over a LAN configuration. There are a number of different ways to send SCPI remote commands to the instrument over LAN. It can be a problem to have multiple users simultaneously accessing the instrument over the LAN. These keys limit that somewhat by disabling the telnet, socket, and/or SICL capability.

Key Path	**System, I/O Config**
Initial S/W Revision	Prior to A.02.00

SCPI Telnet

Turns the SCPI LAN telnet capability On or Off allowing you to limit SCPI access over LAN through telnet.

Key Path	**System, I/O Config, SCPI LAN**
Mode	All
Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle OFF|ON|0|1` `:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?`
Example	:SYST:COMM:LAN:SCPI:TELN:ENAB OFF
Preset	ON
Preset	This is unaffected by Preset but is set to ON with a “Restore System Defaults->Misc”
State Saved	No
Range	On | Off
Initial S/W Revision	Prior to A.02.00

SCPI Socket

Turns the capability of establishing Socket LAN sessions On or Off. This allows you to limit SCPI access over LAN through socket sessions.

Key Path	**System, I/O Config, SCPI LAN**
Mode	All
Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle OFF|ON|0|1` `:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?`
Example	:SYST:COMM:LAN:SCPI:SOCK:ENAB OFF
Preset	ON
Preset	This is unaffected by a Preset but is set to ON with a “Restore System Defaults->Misc”
State Saved	No
Range	On | Off
Initial S/W Revision	Prior to A.02.00

SCPI Socket Control Port (Remote Command Only)

Returns the TCP/IP port number of the control socket associated with the SCPI socket session. This query enables you to obtain the unique port number to open when a device clear is to be sent to the instrument. Every time a connection is made to the SCPI socket, the instrument creates a peer control socket. The port number for this socket is random. The user must use this command to obtain the port number of the control socket. To force a device clear on this socket, open the port and send the string

"DCL " to the instrument.

If this SCPI command is sent to a non SCPI Socket interface, then 0 is returned.

Mode	All
Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTrol?`
Example	:SYST:COMM:LAN:SCPI:SOCK:CONT?
Preset	This is unaffected by Preset or "Restore System Defaults->Misc".
State Saved	No
Range	0 to 65534
Initial S/W Revision	Prior to A.02.00

SICL Server

Turns the SICL server capability On or Off, enabling you to limit SCPI access over LAN through the SICL server. (SICL IEEE 488.2 protocol.)

Parameter	**Description**	**Setting**
Maximum Connections	The maximum number of connections that can be accessed simultaneously	5
Instrument Name	The name (same as the remote SICL address) of your analyzer	inst0
Instrument Logical Unit	The unique integer assigned to your analyzer when using SICL LAN	8
Emulated GPIB Name	The name (same as the remote SICL address) of the device used when communicating with your analyzer	gpib7
Emulated GPIB Logical Unit	The unique integer assigned to your device when it is being controlled using SICL LAN	8
Emulated GPIB Address	The emulated GPIB address assigned to your transmitter tester when it is a SICL server (the same as your GPIB address)	18

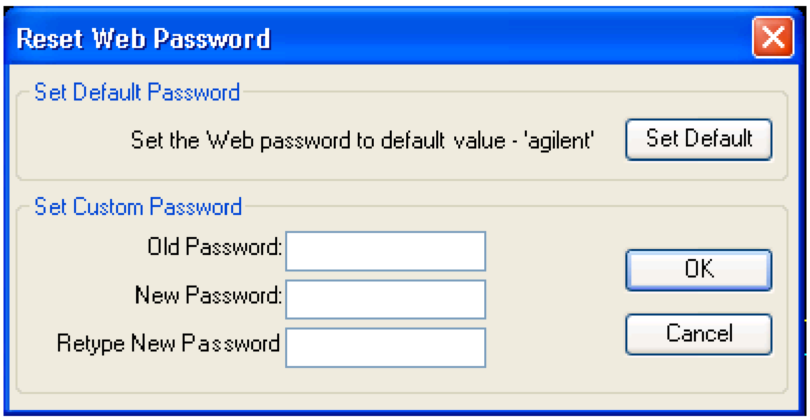
Key Path	**System, I/O Config, SCPI LAN**
Mode	All
Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle OFF|ON|0|1` `:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?`
Example	:SYST:COMM:LAN:SCPI:SICL:ENAB OFF
Preset	ON
Preset	This is unaffected by Preset, but is set to ON with a "Restore System Defaults->Misc"

State Saved	No
Range	On | Off
Initial S/W Revision	Prior to A.02.00

Reset Web Password

The embedded web server contains certain capability which are password protected; modifying the LAN configuration of the instrument, and access to web pages that can change the settings of the instrument. The default password from the factory is ‘agilent’ (without the quotes). The control provided here is the means to set the web password as the user desires, or to reset the password to the factory default.

Selecting Reset web password brings up a control for resetting the password as the user desires, or to the factory default. A keyboard is required to change the password from the factory default of ‘agilent’ or to set a new password that contains alphabetic characters. The control is:



If this control is entered without an external keyboard or mouse connected, you can cancel the control by pressing the Cancel (ESC) front-panel key.

Key Path	**System, I/O Config**
Mode	All
Initial S/W Revision	Prior to A.02.00

Query USB Connection (Remote Command Only)

Enables you to determine the speed of the USB connection.

Mode	All
Remote Command	`:SYSTem:COMMunicate:USB:CONNection?`
Example	:SYST:COMM:USB:CONN?

Notes	NONE – Indicates no USB connection has been made. LSPeed – Indicates a USB low speed connection (1.5 Mbps). Note: this is reserved for future use, the T+M488 protocol is not supported on low speed connections. HSPeed – Indicates that a USB high speed connection (480 Mbps) has been negotiated. FSPeed – Indicates that a USB full speed connection (12 Mbps) has been negotiated.
State Saved	No
Range	NONE|LSPeed|HSPeed|FSPeed
Initial S/W Revision	Prior to A.02.00

USB Connection Status (Remote Command Only)

Enables you to determine the current status of the USB connection.

Mode	All
Remote Command	`:SYSTem:COMMunicate:USB:STATus?`
Example	:SYST:COMM:USB:STAT?
Notes	SUSPended – Indicates that the USB bus is currently in its suspended state. The bus is in the suspended state when: The bus is not connected to any controller The controller is currently powered off The controller has explicitly placed the USB device into the suspended state. When in the suspended state, no USB activity, including start of frame packets are received. ACTive – Indicates that the USB device is in the active state. When the device is in the active state, it is receiving periodic start of frames but it isn't necessarily receiving or transmitting data.
State Saved	No
Range	SUSPended|ACTive
Initial S/W Revision	Prior to A.02.00

USB Packet Count (Remote Command Only)

Enables you to determine the number of packets received and transmitted on the USB bus.

Mode	All
Remote Command	`:SYSTem:COMMunicate:USB:PACKets?`
Example	:SYST:COMM:USB:PACK?

Notes	Two integers are returned. The first is the number of packets received since application invocation, the second is the number of packets transmitted since application invocation. If no packets have been received or transmitted the response is 0,0. The packet count is initialized to 0,0 when the instrument application is started.
State Saved	No
Initial S/W Revision	Prior to A.02.00

LXI

Opens a menu that allows you to access the various LXI configuration properties.

Key Path	**System, I/O Config**
Initial S/W Revision	**Prior to A.02.00**

LAN Reset

Resets the LAN connection.

Key Path	**System, I/O Config, LXI**
Initial S/W Revision	Prior to A.02.00

LXI Domain

The instrument only receives LXI LAN Events sent by members of the same LXI Domain. Conversely, LXI Output LAN Events sent by the instrument can only be received by members of the same LXI Domain. This is not the same as the IEEE 1588 domain (see "Domain (Remote Command Only)" on page 240).

Key Path	**System, I/O Config, LXI**

Remote Command	`:LXI:EVENt:DOMain <intDomain>`
	
	`:LXI:EVENt:DOMain?`

Example	:LXI:EVEN:DOM 128 :LXI:EVEN:DOM?
Preset	0
Preset	Not affected by a Preset. The default value of "0" can be restored by pressing Restore Defs, Input/Output Settings
State Saved	Saved in instrument state.
Range	0–255
Initial S/W Revision	Prior to A.02.00

LXI Output LAN Events

The device can be configured to send LXI LAN Events as the instrument’s state changes. Specifically, it can notify other devices as the status signals WaitingForTrigger, Sweeping, Measuring, OperationComplete, and Recalling transition. Additionally, Output LAN Events can be sent in response to the receipt of any of the Input LAN Events.

This is the entry point for the LXI Output LAN Event system. This key branches to a list of events that can be sent out on the LAN in response to instrument events.

Key Path	**System, I/O Config, LXI**
Initial S/W Revision	Prior to A.02.00

Disable All

This command causes the Enable property of all members of the LXI Output LAN Event List to be set to OFF.

Key Path	**System, I/O Config, LXI, LXI Output LAN Events**
Remote Command	`:LXI:EVENt[:OUTPut]:LAN:DISable:ALL`
Example	:LXI:EVEN:LAN:DIS:ALL
Initial S/W Revision	Prior to A.02.00

Output LAN Event List

This is the list of LXI Output LAN events that can be sent in response to an instrument event such as sweeping or waiting for a trigger. Each member of this list has a key in the LXI Output LAN Events panel. The list can grow and shrink in response to Add and Remove commands respectively. New pages must be added and removed automatically as the list size changes. Only the first 14 characters of an LXI Output LAN Event name are displayed on the key.

Key Path	**System, I/O Config, LXI, LXI Output LAN Events**
Remote Command	`:LXI:EVENt[:OUTPut]:LAN:LIST?`
Example	:LXI:EVEN:LAN:LIST? Returns the complete list of Output LAN Events which is, at minimum: “LAN0”, “LAN1”, “LAN2”, “LAN3”, “LAN4”, “LAN5”, “LAN6”, “LAN7”, “WaitingForTrigger”, “Measuring”, “Sweeping”, OperationComplete”, “Recalling”
Preset	“LAN0”, “LAN1”, “LAN2”, “LAN3”, “LAN4”, “LAN5”, “LAN6”, “LAN7”, “WaitingForTrigger”, Measuring”, Sweeping”, OperationComplete”, “Recalling”
Preset	Not affected by a Preset. The default values can be restored by pressing Restore Defs, Input/Output Settings. Preset/Default values: “LAN0”, “LAN1”, “LAN2”, “LAN3”, “LAN4”, “LAN5”, “LAN6”, “LAN7”, “WaitingForTrigger”, Measuring”, Sweeping”, OperationComplete”, “Recalling”

State Saved	Saved in instrument state.
Readback Text	Displays the value of the LXI Output LAN Event Enabled parameter (Enabled | Disabled). Also displays the value of the LXI Output LAN Event Source parameter (WaitingForTrig | Sweeping | Measuring | OpComplete | Recalling)
Initial S/W Revision	Prior to A.02.00

Add (Remote Command Only)

Adds the provided string to the list of possible LAN events to output as a response to instrument events. As new LAN events are added, keys are generated in the LXI Output LAN Events menu. New key panels are generated as the number of possible LAN events increases past a multiple of six, and the “More” keys are updated to reflect the new number of key panels in the LXI Output LAN Events menu.

Remote Command:	`:LXI:EVENt[:OUTPut]:LAN:ADD "LANEVENT"`
Example:	:LXI:EVEN:LAN:ADD “LANEVENT”
Notes:	The maximum length of the string is 16 characters. Longer strings are concatenated and added to the LXI Output LAN Event list. No event is added if the LAN Event already exists.
State Saved:	No
Range:	Uppercase, Lowercase, Numeric, Symbol except for comma or semicolon
Initial S/W Revision:	Prior to A.02.00

Remove (Remote Command Only)

Removes the provided string from the list of possible LAN events to output as a response to instrument events. As new LAN events are removed, keys are removed from the LXI Output LAN Events menu. Key panels are removed as the number of possible LAN events decreases past a multiple of six, and the “More” keys are updated to reflect the new number of key panels in the LXI Output LAN Events menu. Events from the default list cannot be removed.

Remote Command:	`:LXI:EVENt[:OUTPut]:LAN:REMove[:EVENt] "LANEVENT"`
Example:	:LXI:EVEN:LAN:REM “LANEVENT”
Notes:	The maximum length of the string is 16 characters. Longer strings are concatenated and the resulting LAN Event is removed from the LXI Output LAN Event list. Nothing happens if the LAN event was not introduced using the Add command.
State Saved:	No
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Remove All (Remote Command Only)

Clears the list of custom LAN events (those introduced using the Add command) that are available to output as a response to instrument events. As new LAN events are removed, keys are removed from the LXI Output LAN Events menu. Key panels are removed as the number of possible LAN events decreases past a multiple of six, and the “More” keys are updated to reflect the new number of key panels in the LXI Output LAN Events menu.

Remote Command:	:LXI:EVENt[:OUTPut]:LAN:REMove:ALL
Example:	:LXI:EVEN:LAN:REM:ALL
Notes:	Only LAN Events added with the Add command are removed. Default events cannot be removed.
Initial S/W Revision:	Prior to A.02.00

Source

Sets the instrument event that this LXI Output LAN event is tied to.

The possible instrument events are “WaitingForTrigger”, “Sweeping”, “Measuring”, “OperationComplete”, and “Recalling”.

The key is labeled with the value of the selected source.

For the instrument event specific LXI Output LAN Events “WaitingForTrigger,” “Sweeping,” “Measuring,” “OperationComplete,” and “Recalling,” this parameter is set to the corresponding source value and cannot be changed. For these events, the Source key does not appear.

WaitingForTrigger, Measuring, and Sweeping correspond to the standard trigger state machine activities for which they are named.

OperationComplete is low when a measurement operation is underway. For example, OperationComplete is low throughout a list sweep measurement, even though Sweeping, Measuring, and WaitingForTrigger will undergo a number of transitions. In this case, OperationComplete goes high when the entire list sweep is finished.

Recalling is high while the instrument is actively recalling a state.

Additionally, the Source parameter can be set to the name of any Input LAN Event. This causes the Output LAN Event to be sent upon receipt of the named Input LAN Event. There is no front panel support for these events.

The default list of available Input LAN Events is:

- “LAN0”
- “LAN1”
- “LAN2”
- “LAN3”
- “LAN4”
- “LAN5”
- “LAN6”
- “LAN7”

Key Path	**System, I/O Config, LXI, LXI Output LAN Events, LAN[n]**

Remote Command	`:LXI:EVENt[:OUTPut]:LAN[:SET]:SOURce "LANEVENT", "SourceEvent"` `:LXI:EVENt[:OUTPut]:LAN[:SET]:SOURce? "LANEVENT"`
Example	:LXI:EVEN:LAN:SOUR “LANEVENT”,“WaitingForTrigger”
Notes	The maximum length of the string is 45 characters.
Preset	”Sweeping” (The Output LAN Events “WaitingForTrigger”, “Sweeping”, “Measuring”, “OperationComplete”, and “Recalling” all have default source parameters that match their names)
Preset	Not affected by a Preset. The default values can be restored by pressing Restore Defs, Input/Output Settings. Preset/Default values: **“**Sweeping” (The Output LAN Events “WaitingForTrigger”, “Sweeping”, “Measuring”, “OperationComplete”, and “Recalling” all have default source parameters that match their names)
State Saved	Saved in instrument state.
Range	“WaitingForTrigger”|“Sweeping”|“Measuring”|“OperationComplete”|“Recalling”|”LAN0”|”LAN1”| ”LAN2”| ”LAN3”| ”LAN4”| ”LAN5”| ”LAN6”| ”LAN7”| any user-added Input LAN Event
Initial S/W Revision	Prior to A.02.00

Destination (Remote Command Only)

Outgoing LAN events are sent to the hosts enumerated in the destination expression. This expression takes the form of “host1:port1, host2:port2, ...” where port numbers are optional, and default to the IANA assigned TCP port (5044). To designate a UDP broadcast at the default port, set the destination string to “” or “ALL”. To designate a UDP broadcast at a specific port, set the destination string to “:port” or “ALL:port”.

Examples:

- “192.168.0.1:23”
- “agilent.com, soco.agilent.com”
- “agilent.com:80, 192.168.0.1”

Remote Command:	`:LXI:EVENt[:OUTPut]:LAN[:SET]:DESTination "LANEVENT","destinationExpression"` `:LXI:EVENt[:OUTPut]:LAN[:SET]:DESTination? "LANEVENT"`
Example:	:LXI:EVEN:LAN:DEST “LANEVENT”,“host1, 192.168.0.1:80”
Notes:	The maximum length of the string is 45 characters.
Preset:	“ALL”
Preset:	Not affected by a Preset. The default value of "ALL" can be restored by using the command: :SYSTem:DEFault INPut
State Saved:	Saved in instrument state.

Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Drive

Determines the behavior of an output event.

- Normal designates typical operation, where both edges of the instrument event are transmitted,
- Off disables the LAN event.
- Wired-OR causes only one edge to be transmitted.

Key Path	**System, I/O Config, LXI, LXI Output LAN Events, LAN[n]**
Remote Command	`:LXI:EVENt[:OUTPut]:LAN[:SET]:DRIVe "LANEVENT", OFF|NORMal|WOR` `:LXI:EVENt[:OUTPut]:LAN[:SET]:DRIVe? "LANEVENT"`
Example	:LXI:EVEN:LAN:DRIV "LANEVENT",WOR
Preset	NORMal
Preset	Not affected by a Preset. The default value of "NORMal" can be restored by using the command: :SYSTem:DEFault INPut
State Saved	Saved in instrument state.
Range	OFF|NORMal|WOR
Initial S/W Revision	Prior to A.02.00

Slope

Determines which instrument event transition results in a LAN packet being sent and whether or not that edge is inverted.

When the Drive parameter is set to Normal, a Slope of Negative causes both edges to be inverted before they are transmitted. A Positive Slope transmits the edges unaltered.

When the Drive parameter is set to WOR, only Positive edges are transmitted. When the Slope is Negative, a falling edge is inverted and sent as a rising edge. When the Slope is Positive, a rising edge is sent normally.

The following table illustrates the effects of the Slope and Drive parameters.

Instrument Event Edge	Slope Parameter	Drive Parameter	Action
0	Negative	Off	Not sent
0	Positive	Off	Not sent
1	Negative	Off	Not sent
1	Positive	Off	Not sent

0	Negative	Normal	1
0	Positive	Normal	0
1	Negative	Normal	0
1	Positive	Normal	1
0	Negative	Wired OR	1
0	Positive	Wired OR	Not sent
1	Negative	Wired OR	Not sent
1	Positive	Wired OR	0

Key Path	**System, I/O Config, LXI, LXI Output LAN Events, LAN[n]**
Remote Command	`:LXI:EVENt[:OUTPut]:LAN[:SET]:SLOPe “LANEVENT”, POSitive|NEGative` `:LXI:EVENt[:OUTPut]:LAN[:SET]:SLOPe? “LANEVENT”`
Example	:LXI:EVEN:LAN:SLOP “LANEVENT”,POS
Preset	POSitive
Preset	Not affected by a Preset. The default value of "Positive" can be restored by using the command: :SYSTem:DEFault INPut
State Saved	Saved in instrument state.
Range	POSitive|NEGative
Initial S/W Revision	Prior to A.02.00

Timestamp Delta

This parameter represents a time in seconds to add to the timestamp of the Output LAN Event. This timestamp delta allows the receiving instrument to delay its response until the time specified in the timestamp.

Key Path	**System, I/O Config, LXI, LXI Output LAN Events, LAN[n]**
Remote Command	`:LXI:EVENt[:OUTPut]:LAN[:SET]:TSDelta “LANEVENT”, <seconds>` `:LXI:EVENt[:OUTPut]:LAN[:SET]:TSDelta? “LANEVENT”`
Example	:LXI:EVEN:LAN:TSD “LANEVENT”,10.5 s
Preset	0.0 s
Preset	Not affected by a Preset. The default value of "0.0 s" can be restored by using the command: :SYSTem:DEFault INPut
State Saved	Saved in instrument state.

Range	0.0 – 1.7976931348623157 x 10308 s(Max Double)
Initial S/W Revision	Prior to A.02.00

Enabled

If this parameter is set to ON, this LAN Event is sent when the selected Source instrument event occurs.

Otherwise, this LAN Event is never output.

Key Path	**System, I/O Config, LXI, LXI Output LAN Events, LAN[n]**
Remote Command	:LXI:EVENt[:OUTPut]:LAN[:SET]:ENABled "LANEVENT",ON|OFF|1|0 :LXI:EVENt[:OUTPut]:LAN[:SET]:ENABled? "LANEVENT"
Example	:LXI:EVEN:LAN:ENAB “LAN0”,ON
Preset	OFF
Preset	Not affected by a Preset. The default value of "OFF" can be restored by using the command: :SYSTem:DEFault INPut
State Saved	Saved in instrument state.
Range	OFF|ON|0|1
Initial S/W Revision	Prior to A.02.00

Count (Remote Command Only)

Returns the number of items in the LXI Output LAN Event List.

Remote Command:	:LXI:EVENt[:OUTPut]:LAN:COUNt?
Example:	:LXI:EVEN:LAN:COUN?
Initial S/W Revision:	Prior to A.02.00

Configure (Remote Command Only)

Allows the configuration of some parameters from a single SCPI command.

Remote Command:	:LXI:EVENt[:OUTPut]:LAN[:SET]:CONFigure "lanEvent",<enabled>,<source>,<slope>,<drive>,<destination>
Example:	:LXI:EVEN:LAN:CONF “LAN0”,1,”WaitingForTrigger”,POS,NORM,”ALL”
Initial S/W Revision:	Prior to A.02.00

Send (Remote Command Only)

Forces the instrument to send the requested LAN Event. The LAN Event must be enabled, otherwise this command is ignored.

Remote Command:	`:LXI:EVENt[:OUTPut]:LAN:SEND "LANEVENT"", RISE|FALL`
Example:	:LXI:EVEN:LAN:SEND "LANEVENT", FALL
Initial S/W Revision:	Prior to A.02.00

Identifier (Remote Command Only)

Sets the string that will be placed in the peer-to-peer packet when the Output LAN Event is transmitted. The Identifier is variable to allow for easier system debugging. The Identifier must be unique, for example the "LAN0" and "LAN1" output events cannot have identical identifiers.

Remote Command:	`:LXI:EVENt[:OUTPut]:LAN[:SET]:IDENtifier "LANEVENT", "identifier"` `:LXI:EVENt[:OUTPut]:LAN[:SET]:IDENtifier? "LANEVENT"`
Example:	:LXI:EVEN:LAN:IDEN"LAN0","debugstring"
Notes:	The maximum length of the string is 16 characters. Nothing happens if the LAN event does not exist. The default value is that the identifier is equivalent to the name of the LAN Event.
State Saved:	Saved in instrument state.
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

IEEE 1588 Time (Remote Command Only)

Epoch Time (Remote Command Only)

If the device is selected as the IEEE 1588 master clock, this sets the clock using the number of seconds elapsed since January, 1 1970 at 00:00:00 in International Atomic Time (TAI). Epoch time is time zone invariant. Otherwise, this allows the user to query the epoch time.

Remote Command:	`:LXI:CLOCk[:TIME][:VALue] <seconds>,<fractionalSeconds>`
Example:	:LXI:CLOC 10020304.0 s,0.123456 s
Notes:	The seconds argument must only contain values representing whole seconds. For example 1243.0 s is acceptable, but 1243.01 results in an error. Ignored when the device is not selected as the IEEE 1588 master clock. The fractional portion is only accurate to the microseconds position. Error generated if the seconds argument contains a fractional portion.
Preset:	System time

Preset:	Not affected by a Preset. The default value of "System Time" can be restored by using the command: :SYSTem:DEFault INPut
State Saved:	No
Range:	Seconds: 0.0 – 1.7976931348623157 x 10308 s (Max Double) Fraction: 0.0 s – 0.999999 s
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:LXI:CLOCk[:TIME][:VALue]?`
Example:	:LXI:CLOC?
Notes:	The seconds argument must only contain values representing whole seconds. For example 1243.0 s is acceptable, but 1243.01 results in an error. Ignored when the device is not selected as the IEEE 1588 master clock. The fractional portion is only accurate to the microseconds position. Error generated if the seconds argument contains a fractional portion.
Preset:	System time
State Saved:	No
Range:	Seconds: 0.0 – 1.7976931348623157 x 10308 s (Max Double) Fraction: 0.0 s – 0.999999 s
Initial S/W Revision:	Prior to A.02.00

Seconds (Remote Command Only)

If the device is selected as the IEEE 1588 master clock, this sets the seconds portion of the clock. Otherwise, this allows the user to query the seconds portion of the epoch time. Valid values are in discrete increments of whole seconds.

Remote Command:	`:LXI:CLOCk[:TIME]:SEConds <seconds>` `:LXI:CLOCk[:TIME]:SEConds?`
Example:	:LXI:CLOC:SEC 10020304.0
Notes:	Ignored when the device is not selected as the IEEE 1588 master clock. Error generated if the argument contains a fractional portion. For example 1243.0 s is acceptable, but 1243.01 results in an error.
Preset:	System time
Preset:	Not affected by a Preset. The default value of "System Time" can be restored by using the command: :SYSTem:DEFault INPut

State Saved:	No
Range:	0.0 – 1.7976931348623157 x 10308 s (Max Double)
Initial S/W Revision:	Prior to A.02.00

Fraction (Remote Command Only)

If the device is selected as the IEEE 1588 master clock, this sets the sub-second value of the clock. Otherwise, this allows the user to query the sub-second value of the epoch time.

Remote Command:	:LXI:CLOCk[:TIME]:FRACtion <fraction> :LXI:CLOCk[:TIME]:FRACtion?
Example:	:LXI:CLOC:FRAC 10 ms
Notes:	Ignored when the device is not selected as the IEEE 1588 master clock. Only accurate to the microseconds position.
Preset:	Sub-second value of system time
State Saved:	No
Range:	[0.0,1.0)
Initial S/W Revision:	Prior to A.02.00

Local Time (Remote Command Only)

Returns the current local time formatted as a date time string.

Remote Command:	:LXI:CLOCk[:TIME]:LOCal?
Example:	:LXI:CLOC:LOC? ! Returns “5/15/2007 6:23:34.123456”
Notes:	LXI:CLOCk[:TIME]:LOCal? Returns Any string constituting a valid date and time
Initial S/W Revision:	Prior to A.02.00

Leap Second Offset (Remote Command Only)

Enables you to set the leap second offset between the UTC and TAI time standards.

Remote Command:	:LXI:CLOCk[:TIME]:LSOFfset <integer> :LXI:CLOCk[:TIME]:LSOFfset?
Example:	:LXI:CLOC:LSOF 55
Range:	0 – 2147483647 (Max Integer)
Initial S/W Revision:	Prior to A.02.00

International Atomic Time (Remote Command Only)

Retrieves the current time using the TAI format.

Remote Command:	`:LXI:CLOCk[:TIME]:TAI?`
Example:	:LXI:CLOC:TAI? ! “5/15/2007 6:23:34.123456”
Notes:	:LXI:CLOCk[:TIME]:TAI? Returns Any string constituting a valid date and time
Initial S/W Revision:	Prior to A.02.00

Time Zone (Remote Command Only)

Retrieves the current local time zone as an offset in hours, minutes, and seconds from Greenwich Mean Time.

Remote Command:	`:LXI:CLOCk[:TIME]:TZONe?`
Example:	:LXI:CLOC:TZON?
Notes:	:LXI:CLOC:TZON? returns "01:00:00" if the current local time zone is 1 hour ahead from Greenwich Mean Time
Initial S/W Revision:	Prior to A.02.00

Daylight Savings (Remote Command Only)

Retrieves the current status of the Windows System setting for Daylight Savings Time. Whether or not daylight savings time is in effect influences the time zone parameter.

Remote Command:	`:LXI:CLOCk[:TIME]:DLSavings?`
Example:	:LXI:CLOC:DLS?
Notes:	:LXI:CLOC:DLS? Returns 1 when Daylight Savings Time is On and 0 if the when Daylight Savings Time is Off
Preset:	The Windows system Daylight Savings setting.
Initial S/W Revision:	Prior to A.02.00

Coordinated Universal Time (Remote Command Only)

Retrieves the current time using the UTC format.

Remote Command:	`:LXI:CLOCk[:TIME]:UTC?`
Example:	:LXI:CLOC:UTC? !“5/15/2007 6:23:34.123456”
Notes:	:LXI:CLOC:UTC? Returns Any string constituting a valid date and time
Initial S/W Revision:	Prior to A.02.00

Time Marker (Remote Command Only)

Records the PTP time as a marker that can later be measured against the current PTP time. Typical use is to time the length of a sequence of instrument operations. There are 9 available markers with indices 1 – 9.

Remote Command:	`:LXI:CLOCk[:TIME]:MARKer[1]|2|3|4|5|6|7|8|9[:SET]`
Example:	:LXI:CLOC:MARK1 :LXI:CLOC:MARK2 :LXI:CLOC:MARK3 :LXI:CLOC:MARK4 :LXI:CLOC:MARK5 :LXI:CLOC:MARK6 :LXI:CLOC:MARK7 :LXI:CLOC:MARK8 :LXI:CLOC:MARK9 :LXI:CLOC:MARK
Initial S/W Revision:	Prior to A.02.00

Time Marker Clear (Remote Command Only)

Clears the recorded PTP time marker used to measure against the current PTP time. There are 9 available markers with indices 1 – 9.

Remote Command:	`:LXI:CLOCk[:TIME]:MARKer[1]|2|3|4|5|6|7|8|9:CLEAr`
Example:	:LXI:CLOC:MARK1:CLEA :LXI:CLOC:MARK2:CLEA :LXI:CLOC:MARK3:CLEA :LXI:CLOC:MARK4:CLEA :LXI:CLOC:MARK5:CLEA :LXI:CLOC:MARK6:CLEA :LXI:CLOC:MARK7:CLEA :LXI:CLOC:MARK8:CLEA :LXI:CLOC:MARK9:CLEA :LXI:CLOC:MARK:CLEA
Initial S/W Revision:	Prior to A.02.00

Time Marker Delta (Remote Command Only)

Calculates and returns the delta time from the marker to the present PTP time. Also returns the seconds and sub-seconds portions of the start and end times. There are 9 available markers with indices 1 – 9.

<table>
<tr><th>Remote Command:</th><th>:LXI:CLOCk[:TIME]:MARKer[1]|2|3|4|5|6|7|8|9:DELTa?</th></tr>
<tr><td>Example:</td><td>:LXI:CLOC:MARK1:DELT? ! returns <deltaTime>,<startSeconds>,<startFractionalSeconds>,<endSeconds>,<endFractionalSeconds>
:LXI:CLOC:MARK2:DELT?
:LXI:CLOC:MARK3:DELT?
:LXI:CLOC:MARK4:DELT?
:LXI:CLOC:MARK5:DELT?
:LXI:CLOC:MARK6:DELT?
:LXI:CLOC:MARK7:DELT?
:LXI:CLOC:MARK8:DELT?
:LXI:CLOC:MARK9:DELT?
:LXI:CLOC:MARK:DELT?</td></tr>
<tr><td>Notes:</td><td>:LXI:CLOCk[:TIME]:MARKer[1]|2|3|4|5|6|7|8|9:DELTa? Returns a value between 0.0 – 1.7976931348623157 x 10308 s (Max Double)</td></tr>
<tr><td>Range:</td><td>0.0 – 1.7976931348623157 x 10308 s (Max Double)</td></tr>
<tr><td>Initial S/W Revision:</td><td>Prior to A.02.00</td></tr>
</table>

Measurement Data Timestamp (Remote Command Only)

Returns the beginning and ending times of the last measurement cycle. This command also returns the duration of the measurement cycle. These values correspond to the last rising and falling transition of the Measuring instrument event.

<table>
<tr><th>Remote Command:</th><th>:LXI:CLOCk[:TIME]:MEASure[:DELTa]?</th></tr>
<tr><td>Example:</td><td>:LXI:CLOC:MEAS? !Returns 2.0,1145902.0,0.123456, ,1145904.0,0.123456</td></tr>
<tr><td>Notes:</td><td>:LXI:CLOCk[:TIME]:MARKer[1]|2|3|4|5|6|7|8|9:DELTa? Returns a value between 0.0 – 1.7976931348623157 x 10308 s (Max Double)</td></tr>
<tr><td>Initial S/W Revision:</td><td>Prior to A.02.00</td></tr>
</table>

Clear Measurement Data Timestamp (Remote Command Only)

Forces the return values of the Measurement Data Timestamp to zero until the next measurement cycle occurs. This command need not be issued for the Measurement Data Timestamp to be refreshed.

Remote Command:	:LXI:CLOCk[:TIME]:MEASure:CLEar
Example:	:LXI:CLOC:MEAS:CLE
Initial S/W Revision:	Prior to A.02.00

Precision Time Protocol

Precision Time Protocol, as defined by IEEE 1588, is a method for synchronizing the time across a network. Instruments participating in the PTP network can coordinate activities using this common time base.

Accuracy (Remote Command Only)

Sets the typical offset from the correct time that a user can expect from the instrument PTP clock. This parameter is used when the instrument is selected as the Master clock. It should be set along with the time when configuring a master clock.

The value should be chosen by judging how precisely the clock can be set to the exact TAI time and the accuracy and drift of the clock's underlying oscillator.

This is an input to the IEEE 1588 Best Master Clock algorithm.

Remote Command:	`:LXI:CLOCk:PTP:ACCuracy NS25|NS100|NS250|NS1000|NS2500|US10|US25|US100|US250|US1000|US2500|MS10|MS25|MS100|MS1000|S10|GT10S|UNKNown` `:LXI:CLOCk:PTP:ACCuracy?`
Example:	:LXI:CLOC:PTP:ACC US25
Preset:	GT10S
Preset:	Not affected by a Preset. The default value of "GT10S" can be restored by using the command: SYSTem:DEFault INPut
Range:	NS25|NS100|NS250|NS1000|NS2500|US10|US25|US100|US250|US1000|US2500|MS10|MS25|MS100|MS1000|S10|GT10S|UNKNown
Initial S/W Revision:	Prior to A.02.00

Announce Interval (Remote Command Only)

Sets the time in seconds between PTP announce packets. A shorter interval makes the system more responsive to changes in the master clock at the cost of network bandwidth and packet processing time. The announce interval should be constant across all the instruments in the network. The announce interval will be rounded to the nearest non-negative integer power of two, with a maximum value of 16.

Remote Command:	`:LXI:CLOCk:PTP:ANNounce:INTerval <interval>` `:LXI:CLOCk:PTP:ANNounce:INTerval?`
Example:	:LXI:CLOC:PTP:ANN:INT 1
Preset:	2
Preset:	Not affected by a Preset. The default value of "4" can be restored by using the command: SYSTem:DEFault INPut
Range:	1|2|4|8|16

Initial S/W Revision:	Prior to A.02.00

Announce Receipt Time Out (Remote Command Only)

Sets the number of announce intervals that the instrument waits to receive an announce packet while in the Slave or Listening. After this number of announce intervals, the instrument will transition to the Master state.

Remote Command:	`:LXI:CLOCk:PTP:ANNounce:RTOut <numberOfIntervals>` `:LXI:CLOCk:PTP:ANNounce:RTOut?`
Example:	:LXI:CLOC:PTP:ANN:RTO 5
Preset:	3
Preset:	Not affected by a Preset. The default value of "3" can be restored by using the command: SYSTem:DEFault INPut
Min:	2
Max:	10
Initial S/W Revision:	Prior to A.02.00

Clock Class (Remote Command Only)

Returns a ranking of the master clock suitability relative to other clocks on the network. A lower value represents a more suitable clock.

Suitability is defined by the IEEE 1588 standard section 7.6.2.4

Remote Command:	`:LXI:CLOCk:PTP:CCLass?`
Example:	:LXI:CLOC:PTP:CCL?
Preset:	248
Preset:	Not affected by a Preset. The default value of "248" can be restored by using the command: SYSTem:DEFault INPut
Min:	6
Max:	248
Initial S/W Revision:	Prior to A.02.00

Deviation (Remote Command Only)

Returns the standard deviation of the instrument’s PTP time from the Grandmaster’s PTP time.

Remote Command:	`:LXI:CLOCk:PTP:DEViation?`
Example:	:LXI:CLOC:PTP:DEV?

Initial S/W Revision:	Prior to A.02.00

Domain (Remote Command Only)

The instrument synchronizes its clock only with other clocks in the same domain.

Remote Command:	`:LXI:CLOCk:PTP:DOMain <domainNumber>` `:LXI:CLOCk:PTP:DOMain?`
Example:	:LXI:CLOC:PTP:DOM 0
Preset:	0
Preset:	Not affected by a Preset. The default value of "0" can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	127
Initial S/W Revision:	Prior to A.02.00

Offset (Remote Command Only)

Returns the difference between the instrument clock PTP time and the Master clock PTP time.

Remote Command:	`:LXI:CLOCk:PTP:OFFSet?`
Example:	:LXI:CLOC:PTP:OFFS?
Range:	0.0 to – 1.7976931348623157 x 10308 s (Min Double)
Initial S/W Revision:	Prior to A.02.00

First Priority (Remote Command Only)

Setting this parameter overrides the IEEE 1588 Best Master Clock algorithm. If an instrument’s First Priority parameter is smaller than all other clocks in its domain, it is chosen as the Master clock.

Remote Command:	`:LXI:CLOCk:PTP:PRIority:FIRSt <priority>` `:LXI:CLOCk:PTP:PRIority:FIRSt?`
Example:	:LXI:CLOC:PTP:PRI:FIRS 50
Preset:	128
Preset:	Not affected by a Preset. The default value of "128" can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	255

Initial S/W Revision:	Prior to A.02.00

Second Priority (Remote Command Only)

When two or more clocks are determined to be equally good by the Best Master Clock algorithm, the clock with the lowest Second Priority value is chosen to be the Master Clock.

Remote Command:	`:LXI:CLOCk:PTP:PRIority:SECond <priority>` `:LXI:CLOCk:PTP:PRIority:SECond?`
Example:	:LXI:CLOC:PTP:PRI:SEC 50
Preset:	128
Preset:	Not affected by a Preset. The default value of "128" can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	255
Initial S/W Revision:	Prior to A.02.00

State (Remote Command Only)

Returns the current state of the instrument’s PTP clock as defined in the IEEE 1588 standard.

Remote Command:	`:LXI:CLOCk:PTP:STATe?`
Example:	:LXI:CLOC:PTP:STAT?
Range:	INITializing|FAULty|DISabled|LISTening|PREMaster| MASTer|PASSive|UNCalibrated|SLAVe
Initial S/W Revision:	Prior to A.02.00

Traceability (Remote Command Only)

Returns the quality of the instrument’s PTP clock source of time when chosen as the Grand Master clock.

This parameter is used by the Best Master Clock algorithm.

Remote Command:	`:LXI:CLOCk:PTP:TRACeability?`
Example:	:LXI:CLOC:PTP:TRAC?
Range:	ATOMic|GPS|RADio|PTP|NTP|HANDset|OTHer|OSCillator
Initial S/W Revision:	Prior to A.02.00

Variance (Remote Command Only)

Returns the variance of the instrument’s PTP clock time relative to the Master’s PTP clock time.

Remote Command:	:LXI:CLOCk:PTP:VARiance?
Example:	:LXI:CLOC:PTP:VAR?
Range:	0.0 – 1.7976931348623157 x 10308 (Max Double)
Initial S/W Revision:	Prior to A.02.00

Sync Interval (Remote Command Only)

Sets the rate at which PTP sync packets are transmitted when this instrument is acting as a Master PTP clock. The values must be integer powers of 2.

Remote Command:	:LXI:CLOCk:PTP:SINTerval <seconds>
Example:	:LXI:CLOC:PTP:SINT 0.25s
Preset:	1
Preset:	Not affected by a Preset. The default value of "1" can be restored by using the command: SYSTem:DEFault INPut
Range:	0.0625s|0.125s|0.25s|0.5s|1s|2s
Initial S/W Revision:	Prior to A.02.00

Remote Command:	:LXI:CLOCk:PTP:SINTerval?
Example:	:LXI:CLOC:PTP:SINT?
Preset:	1
Range:	0.0625s|0.125s|0.25s|0.5s|1s|2s
Initial S/W Revision:	Prior to A.02.00

Delay Request Interval (Remote Command Only)

This property is used by the master clock to specify the interval between delay request packets sent from the slave to the master clock. Slaves use a randomly-chosen interval, with mean equal to this property.

The value for this parameter must be an integer power of two.

Remote Command:	:LXI:CLOCk:PTP:DRINterval <seconds>
Example:	:LXI:CLOC:PTP:DRIN 15 ms
Preset:	8 s

Preset:	Not affected by a Preset. The default value of "8 s" can be restored by using the command: SYSTem:DEFault INPut
Range:	1 s | 2 s | 4 s | 8 s | 16 s | 32 s
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:LXI:CLOCk:PTP:DRINterval?`
Example:	:LXI:CLOC:PTP:DRIN 15 ms
Preset:	8 s
Min:	0.0 s
Max:	2^32 = 4294967296 s
Initial S/W Revision:	Prior to A.02.00

Grand Master

In the IEEE 1588 the best clock in the system, as determined by the Best Master Clock algorithm, is chosen as the Grand Master clock. The Grand Master clock is the ultimate source of time which all other clocks attempt to synchronize to. If the network is limited to a single subnet, the Master clock and the Grand Master clock are synonymous.

If a network spans multiple subnets, boundary clocks must be utilized to segment the network. Each subnet then selects a Master Clock using the Best Master Clock algorithm. From this population of Master Clocks, the best clock is selected to be the Grand Master clock.

Accuracy (Remote Command Only)

Returns the relative accuracy of the Grand Master clock.

Remote Command:	`:LXI:CLOCk:PTP:GMASter:ACCuracy?`
Example:	:LXI:CLOC:PTP:GMAS:ACC? !For example, this might return GT10S.
Range:	25NS|100NS|250NS|1US|2.5US|10US|25US|100US|250US|1MS|2.5MS|10MS|25MS|100MS|1S|10S|GT10S|UNKNown
Initial S/W Revision:	Prior to A.02.00

MAC Address (Remote Command Only)

Returns the Grand Master’s MAC Address.

Remote Command:	`:LXI:CLOCk:PTP:GMASter:MADDress?`
Example:	:LXI:CLOC:PTP:GMAS:MADD? !For example, this might return "00–00–50–1e-ca-ad".
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Traceability (Remote Command Only)

Describes the quality of the Grand Master PTP clock's source of time.

Remote Command:	:LXI:CLOCk:PTP:GMASter:TRACeability?
Example:	:LXI:CLOC:PTP:GMAS:TRAC? !For example, this might return OSC.
Range:	ATOMic|GPS|RADio|PTP|NTP|HANDset|OTHer|OSCillator
Initial S/W Revision:	Prior to A.02.00

Master

Instruments on the same subnet use the Best Master Clock algorithm to select a Master clock. The Master clock is used as the basis for synchronization.

MAC Address (Remote Command Only)

Returns the Master's MAC Address.

Remote Command:	:LXI:CLOCk:PTP:MASTer:MADDress?
Example:	:LXI:CLOC:PTP:MAST:MADD?
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Servo Algorithm (Remote Command Only)

The Servo Algorithm parameters are considered advanced settings for tweaking IEEE 1588 performance.

Log (Remote Command Only)

The Servo Log records measurements of the offset between the instrument's PTP clock and the Master's PTP clock. It also records the packet travel time for Master-to-Slave and Slave-to-Master transactions.

Next (Remote Command Only)

Retrieves and removes the oldest entry from the Servo Log. The format for a servo log entry is as follows

Sample Index:	integer representing entry order
Time Seconds:	seconds portion of the entry timestamp
Time Fraction:	sub-second portion of the entry timestamp
Offset Seconds:	offset between the instrument's PTP clock and the Master's PTP clock
Average Delay Seconds:	the average measured transmission delay
Master Delay Seconds:	Master-to-Slave packet travel time
Slave Delay Seconds:	Slave-to-Master packet travel time

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG[:NEXT]?`
Example:	:LXI:CLOC:SALG:LOG?
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Circular (Remote Command Only)

Sets the behavior for entries occurring while the Servo Log is full.

- If Circular is set to 1, incoming events overwrite the oldest events in the log.
- If Circular is set to 0, incoming events are discarded.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:CIRCular[:ENABled] ON|OFF|0|1` `:LXI:CLOCk:SALGorithm:LOG:CIRCular[:ENABled]?`
Example:	:LXI:CLOC:SALG:LOG:CIRC 1
Preset:	1
Preset:	Not affected by a Preset. The default value of "1" can be restored by using the command: SYSTem:DEFault INPut
Range:	ON|OFF|0|1
Initial S/W Revision:	Prior to A.02.00

Beginning Entry (Remote Command Only)

Sets or freezes the beginning entry of the log when in circular mode to the most recently added entry at the time of the command. This is so that the :LXI:EVENt:LOG:ENTtry? command has a reference entry for indexing individual entries in the log.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:CIRCular:FBENtry`
Example:	LXI:CLOCk:SALG:LOG:CIRC:FBEN
Initial S/W Revision:	Prior to A.02.00

Clear (Remote Command Only)

Clears all entries from the Servo Log.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:CLEar`
Example:	:LXI:CLOC:SALG:LOG:CLE
Initial S/W Revision:	Prior to A.02.00

Count (Remote Command Only)

Returns the number of unread entries in the Servo Log.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:COUNt?`
Example:	:LXI:CLOC:SALG:LOG:COUN?
Range:	0 - IEEE 1588 Servo Log Size
Initial S/W Revision:	Prior to A.02.00

Enabled (Remote Command Only)

- When the Servo Log is disabled, no events are recorded.
- When it is enabled, the Servo Log is active.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:ENABled ON|OFF|0|1` `:LXI:CLOCk:SALGorithm:LOG:ENABled?`
Example:	:LXI:CLOC:SALG:LOG:ENAB 1
Preset:	0
Preset:	Not affected by a Preset. The default value of "0" can be restored by using the command: SYSTem:DEFault INPut
Range:	ON|OFF|0|1
Initial S/W Revision:	Prior to A.02.00

Size (Remote Command Only)

Sets the maximum number of entries to store in the Servo Log.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:SIZE <maxLogEntries>` `:LXI:CLOCk:SALGorithm:LOG:SIZE?`
Example:	:LXI:CLOC:SALG:LOG:SIZE 100
Preset:	256
Preset:	Not affected by a Preset. The default value of "256" can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	1024
Initial S/W Revision:	Prior to A.02.00

All (Remote Command Only)

Non-destructively returns the entire contents of the Servo Log.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:ALL?`
Example:	:LXI:CLOC:SALG:LOG?
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Specific Entry (Remote Command Only)

Non-destructively returns a specifically indexed entry from within the Servo Log.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:ENTRy? <intIndex>`
Example:	:LXI:CLOC:SALG:LOG? 0 !Returns the oldest entry in the Servo Log. Example of result : "1,1208978798,139644871,0.000000000,3.393600e+038,0.000000000,0.000000000,0.000000000"
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Statistics (Remote Command Only)

Returns the long-term statistics of the servo log that characterizes the performance of the instrument PTP clock's offset from the master PTP clock. The statistics include the following values:

- Number of samples (an integer)
- Mean offset (a double)
- Standard deviation of the offset (a double)
- Maximum offset (a double)
- Minimum offset (a double)

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:STATistics[:DATA]?`
Example:	:LXI:CLOC:SALG:LOG:STAT? ! Example of result : "3643,0.000000000,0.000000000,0.000000000,0.000000000"
Initial S/W Revision:	Prior to A.02.00

Clear Statistics (Remote Command Only)

Resets the long-term servo performance statistics.

Remote Command:	`:LXI:CLOCk:SALGorithm:LOG:STATistics:CLEar`
Example:	:LXI:CLOC:SALG:LOG:STAT? ! Example of result : "3643,0.000000000,0.000000000,0.000000000,0.000000000"

Initial S/W Revision:	Prior to A.02.00

Asymmetry (Remote Command Only)

Sets the difference in seconds between the Master-to-Slave packet travel time and the Slave-to-Master packet travel time.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:ASYMmetry <seconds>` `:LXI:CLOCk:SALGorithm[:SET]:ASYMmetry?`
Example:	:LXI:CLOC:SALG:ASYM 15 ns
Preset:	0.0 s
Preset:	Not affected by a Preset. The default value of "0.0 s " can be restored by using the command: SYSTem:DEFault INPut
Min:	–1
Max:	1
Initial S/W Revision:	Prior to A.02.00

Coarse/Fine Threshold (Remote Command Only)

Determines when the PTP clock Servo algorithm uses the ‘Fine’ or ‘Coarse’ parameters for adjusting the instrument’s PTP clock time. The threshold is measured against a running estimate of the servo variance.

Coarse mode causes a slave clock to converge with the master clock more quickly, but it is more sensitive to noise, while Fine mode filters out noise more effectively, but takes longer to converge.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:CFTHreshold <secondsSquared>` `:LXI:CLOCk:SALGorithm[:SET]:CFTHreshold?`
Example:	:LXI:CLOC:SALG:CFTH 0.25
Preset:	1.0e–11
Preset:	Not affected by a Preset. The default value of "1.0e–11 " can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	1
Initial S/W Revision:	Prior to A.02.00

Coarse Proportional Constant (Remote Command Only)

This constant is used by the servo when above the Coarse/Fine Threshold variance. Decreasing this constant causes the servo to become less responsive to both noise in the system and changes in the Master Clock’s rate. Conversely, increasing this constant causes the servo to respond more energetically to both system noise and changes in the

Master Clock's rate.

The ratio between the Proportional and Integral constants should remain roughly constant.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:CPConstant <servoConstant>` `:LXI:CLOCk:SALGorithm[:SET]:CPConstant?`
Example:	:LXI:CLOC:SALG:CPC 0.5
Preset:	0.4
Preset:	Not affected by a Preset. The default value of "0.4 " can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	1
Initial S/W Revision:	Prior to A.02.00

Coarse Integral Constant (Remote Command Only)

This constant is used by the servo when above the Coarse/Fine Threshold variance. Decreasing this constant causes the servo to become less responsive to both noise in the system and changes in the Master Clock's rate. Conversely, increasing this constant causes the servo to respond more energetically to both system noise and changes in the Master Clock's rate.

The ratio between the Proportional and Integral constants should remain roughly constant.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:CIConstant <servoConstant>` `:LXI:CLOCk:SALGorithm[:SET]:CIConstant?`
Example:	:LXI:CLOC:SALG:CIC 0.5
Preset:	0.2
Preset:	Not affected by a Preset. The default value of "0.2 " can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	1
Initial S/W Revision:	Prior to A.02.00

Fine Proportional Constant (Remote Command Only)

This constant is used by the servo when below the Coarse/Fine Threshold variance. Decreasing this constant causes the servo to become less responsive to both noise in the system and changes in the Master Clock's rate. Conversely, increasing this constant causes the servo to respond more energetically to both system noise and changes in the Master Clock's rate.

The ratio between the Proportional and Integral constants should remain roughly constant.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:FPConstant <servoConstant>` `:LXI:CLOCk:SALGorithm[:SET]:FPConstant?`
Example:	:LXI:CLOC:SALG:FPC 1
Preset:	0.35
Preset:	Not affected by a Preset. The default value of "0.35 " can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	1
Initial S/W Revision:	Prior to A.02.00

Fine Integral Constant (Remote Command Only)

This constant is used by the servo when below the Coarse/Fine Threshold variance. Decreasing this constant causes the servo to become less responsive to both noise in the system and changes in the Master Clock’s rate. Conversely, increasing this constant causes the servo to respond more energetically to both system noise and changes in the Master Clock’s rate.

The ratio between the Proportional and Integral constants should remain roughly constant.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:FIConstant <servoConstant>` `:LXI:CLOCk:SALGorithm[:SET]:FIConstant?`
Example:	:LXI:CLOC:SALG:FIC 0.6
Preset:	0.05
Preset:	Not affected by a Preset. The default value of "0.05" can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	1
Initial S/W Revision:	Prior to A.02.00

Maximum Outlier Discard Count (Remote Command Only)

Sets the maximum number of outlier packets to ignore. After this maximum is exceeded, the next packet is accepted, regardless of whether or not it is flagged as an outlier.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:OMAXimum <consecutiveSamples>` `:LXI:CLOCk:SALGorithm[:SET]:OMAXimum?`

Example:	:LXI:CLOC:SALG:OMAX 3
Preset:	5
Preset:	Not affected by a Preset. The default value of "5" can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	25
Initial S/W Revision:	Prior to A.02.00

Outlier Threshold (Remote Command Only)

Defines the threshold for determining whether a packet is considered a statistical outlier. If a sync or delay request is held up in a switch for a significant amount of time, the quality of synchronization will be perturbed. The servo ignores anything outside the outlier threshold. This parameter is expressed as a number of standard deviations from the currently measured average packet latency. Note that the value can be set to fractional standard deviations.

Remote Command:	:LXI:CLOCk:SALGorithm[:SET]:OTHReshold <standardDeviations> :LXI:CLOCk:SALGorithm[:SET]:OTHReshold?
Example:	:LXI:CLOC:SALG:OTHR 1.0
Preset:	5.0
Preset:	Not affected by a Preset. The default value of "5.0" can be restored by using the command: SYSTem:DEFault INPut
Min:	0.25
Max:	6.0
Initial S/W Revision:	Prior to A.02.00

Outlier Threshold Enable (Remote Command Only)

Enables the outlier threshold to determine whether or not outliers are discarded.

Remote Command:	:LXI:CLOCk:SALGorithm[:SET]:OTENable ON|OFF|1|0 :LXI:CLOCk:SALGorithm[:SET]:OTENable?
Example:	:LXI:CLOC:SALG:OTEN OFF
Preset:	OFF
Preset:	Not affected by a Preset. The default value of "OFF" can be restored by using the command: SYSTem:DEFault INPut
Initial S/W Revision:	Prior to A.02.00

Set/Steer Threshold (Remote Command Only)

If the instrument’s clock deviates from the master by an amount equal to or greater than this threshold, it is reset to match the master rather than being gradually steered toward it.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:STHReshold <seconds>` `:LXI:CLOCk:SALGorithm[:SET]:STHReshold?`
Example:	:LXI:CLOC:SALG:STHR 15 ms
Preset:	0.1 s
Preset:	Not affected by a Preset. The default value of "0.1 s " can be restored by using the command: SYSTem:DEFault INPut
Min:	0.0001
Max:	10.0
Initial S/W Revision:	Prior to A.02.00

Configure (Remote Command Only)

Allows the configuration of some of the above parameters from a single SCPI command.

Remote Command:	`:LXI:CLOCk:SALGorithm[:SET]:CONFigure <asymmetry>, <coarse fine threshold>, <cpc>, <cic>, <fpc>, <fic>, <maximum outlier discard>, <outlier threshold>, <set/steer threshold>`
Example:	:LXI:CLOC:SALG:CONF 0.0, 2.0E–13, 0.4, 0.2, 0.35, 0.05, 5, 2.0E–4, 0.1s
Initial S/W Revision:	Prior to A.02.00

Synchronization (Remote Command Only)

Synchronization parameters are used to control the behavior of the LAN communication used to achieve converging times across the system.

Master (Remote Command Only)

Reports whether or not the device has been selected as the PTP master clock.

Remote Command:	`:LXI:CLOCk:SYNC:MASTer?`
Example:	:LXI:CLOC:SYNC:MAST?
Range:	ON|OFF|0|1
Initial S/W Revision:	Prior to A.02.00

Local Enabled (Remote Command Only)

Enable steering of the local clock with the PTP IEEE 1588 clock.

Remote Command:	`:LXI:CLOCk:SYNC:LOCal:ENABled ON|OFF|0|1` `:LXI:CLOCk:SYNC:LOCal:ENABled?`
Example:	:LXI:CLOC:SYNC:LOC:ENAB ON
Preset:	OFF
Preset:	Not affected by a Preset. The default value of "ON" can be restored by using the command: SYSTem:DEFault INPut
Range:	ON|OFF|0|1
Initial S/W Revision:	Prior to A.02.00

Local Interval (Remote Command Only)

The local clock is updated after the time set in the Local Interval elapses.

Remote Command:	`:LXI:CLOCk:SYNC:LOCal:INTerval` `:LXI:CLOCk:SYNC:LOCal:INTerval?`
Example:	:LXI:CLOC:SYNC:LOC:INT 60
Preset:	60
Preset:	Not affected by a Preset. The default value of "60 " can be restored by using the command: SYSTem:DEFault INPut
Min:	0
Max:	3600
Initial S/W Revision:	Prior to A.02.00

Instrument Status Events

Instrument status events represent internal state changes that are important for synchronization. The recognized Status Events are:

WaitingForTrigger:	Transitions high when the measurement is awaiting a trigger event. Transitions low when the trigger event occurs or the measurement is aborted.
Sweeping:	Transitions high when the instrument begins sweeping. Transitions low when the sweep is completed.
Measuring:	Transitions high when measurement data is being recorded. Transitions low when measurement data is no longer being recorded.

OperationComplete:	Transitions low when a measurement operation is in progress. In some cases (for example, ListSweep), multiple sweeps are taken during a single measurement operation. Transitions high when the measurement operation is finished or aborted.
Recalling:	Transitions high while the instrument is recalling a previous state. Transitions low when a recall is not in progress.

Enable (Remote Command Only)

Setting the enabled parameter to ON enables the selected instrument event to be used as a source for Output LAN Events. Enabling an Instrument Status Event also causes the event to appear in the Event Log.

Remote Command:	`:LXI:EVENt:STATus[:ENABled] "STATUSEVENT",ON|OFF|1|0`
Example:	:LXI:EVEN:STAT "WaitingForTrigger",1
Preset:	ON
Preset:	Not affected by a Preset. The default value of "1" can be restored by using the command, :SYSTem:DEFault INPut.
State Saved:	Saved in instrument state.
Range:	1|0|ON|OFF
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:LXI:EVENt:STATus[:ENABled]? "STATUSEVENT"`
Example:	:LXI:EVEN:STAT? "WaitingForTrigger" Returns 1 if previously enabled. Otherwise, returns 0.
Preset:	ON
State Saved:	Saved in instrument state.
Range:	1|0|ON|OFF
Initial S/W Revision:	Prior to A.02.00

LXI State Recall

The LXI Event system can be used to recall states upon receipt of LXI Input LAN Events.

Location (Remote Command Only)

This parameter is used to store the file paths of the state files to be recalled when each Input LAN Event is received. Since each LAN Event has its own Location entry, a given state is capable of branching to at least 8 different states. If custom Input events are added, an even greater branching factor is possible.

When setting up state transitions, it is important to set the location of the next state before saving. This way, when the saved state is recalled, the next state locations are also automatically recalled.

Remote Command:	`:LXI:EVENt:INPut:LAN:LOCation "LANEVENT","path"`
Example:	:LXI:EVEN:INP:LAN:LOC "LANEVENT","c:\states\state01.state"
Notes:	The maximum length of the string is 512 characters.
State Saved:	Saved in instrument state.
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:LXI:EVENt:INPut:LAN:LOCation? "LANEVENT"`
Example:	:LXI:EVEN:INP:LAN:LOC? "LANEVENT" Returns "c:\states\state01.state" if that value was previously entered
Notes:	The maximum length of the string is 512 characters.
State Saved:	Saved in instrument state.
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Disable All (Remote Command Only)

Causes all LXI Input LAN Events to go into the disabled state (Enabled = OFF).

Remote Command:	`:LXI:EVENt:INPut:LAN:DISable:ALL`
Example:	:LXI:EVEN:INP:LAN:DIS:ALL
Initial S/W Revision:	Prior to A.02.00

Add (Remote Command Only)

Adds the provided string to the list of possible LAN events to Input as a response to instrument events. As new LAN events are added, keys are generated in the LXI Input LAN Events menu. New key panels are generated as the number of possible LAN events increases past a multiple of six, and the "More" keys are updated to reflect the new number of key panels in the LXI Input LAN Events menu.

Remote Command:	`:LXI:EVENt:INPut:LAN:ADD "LANEVENT"`
Example:	:LXI:EVEN:INP:LAN:ADD "LANEVENT"
Notes:	The maximum length of the string is 16 characters. Longer strings are concatenated and added to the LXI Input LAN Event list. No event is added if the LAN Event already exists.
State Saved:	No
Range:	Uppercase, Lowercase, Numeric, Symbol except for comma or semicolon

Initial S/W Revision:	Prior to A.02.00

Remove (Remote Command Only)

Removes the provided string from the list of LXI Input LAN Events. As new LAN events are removed, keys are removed from the LXI Input LAN Events menu. Key panels are removed as the number of possible LAN events decreases past a multiple of six, and the “More” keys are updated to reflect the new number of key panels in the LXI Input LAN Events menu. Events from the default list cannot be removed.

Remote Command:	`:LXI:EVENt:INPut:LAN:REMove[:EVENt] "LANEVENT"`
Example:	:LXI:EVEN:INP:LAN:REM “LANEVENT”
Notes:	The maximum length of the string is 16 characters. Longer strings are concatenated and the resulting LAN Event is removed from the LXI Input LAN Event list. Nothing happens if the LAN event was not introduced using the Add command.
State Saved:	No
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Remove All (Remote Command Only)

Clears the list of custom LAN events (those introduced using the Add command). As new LAN events are removed, keys are removed from the LXI Input LAN Events menu. Key panels are removed as the number of possible LAN events decreases past a multiple of six, and the “More” keys are updated to reflect the new number of key panels in the LXI Input LAN Events menu.

Remote Command:	`:LXI:EVENt:INPut:LAN:REMove:ALL`
Example:	:LXI:EVEN:INP:LAN:REM:ALL
Notes:	Only LAN Events added with the Add command are removed. Default events cannot be removed.
Initial S/W Revision:	Prior to A.02.00

Filter (Remote Command Only)

Only LXI Input LAN Events coming from hosts matching the filter string are processed. There is no Key Path to this command

The syntax for specifying a filter is as follows:

Filter == ([host[:port]] | [ALL[:port]]) [,Filter]

Specifying an empty string means that LXI trigger packets are accepted as an Input from any port on any host on the network via either TCP or UDP.

Specifying only the port means that any host communicating over that port can send events.

Specifying ALL indicates that UDP multicast packets are accepted if they are directed to the IANA assigned multicast address on the IANA assigned default port, or the designated port if specified.

Examples:

- "192.168.0.1:23"
- "agilent.com, soco.agilent.com"
- "agilent.com:80, 192.168.0.1"
- The LXI:EVENt:INPut:LAN:FILTer command applies only to state events and will have no effect on trigger events, even when both are tied to the same event name (like "LAN0"). Similarly, the TRIGger:LXI:LAN:FILTer command applies only to trigger events and will have no effect on state events.

Remote Command:	`:LXI:EVENt:INPut:LAN:FILTer "LANEVENT","filterString"` `:LXI:EVENt:INPut:LAN:FILTer?`
Example:	:LXI:EVEN:INP:LAN:FILT "LAN0","agilent.com" :LXI:EVEN:INP:LAN:FILT?
Notes:	The maximum length of the string is 45 characters. Nothing happens if the LAN event does not exist.
State Saved:	Saved in instrument state.
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Identifier (Remote Command Only)

Sets the string that is expected to arrive over the LAN for a given Input LAN Event to occur. The Identifier is variable to allow for easier system debugging.

Remote Command:	`:LXI:EVENt:INPut:LAN:IDENtifier "LANEVENT","identifier"` `:LXI:EVENt:INPut:LAN:IDENtifier? "LANEVENT"`
Example:	:LXI:EVEN:INP:LAN:IDEN "LAN0","debugstring"
Notes:	The maximum length of the string is 16 characters. Nothing happens if the LAN event does not exist. The default value is that the identifier is equivalent to the name of the LAN Event.
State Saved:	Saved in instrument state.
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Detection (Remote Command Only)

Selects the triggering option..

- Selecting “Rise” causes the instrument to trigger on the receipt of a signal low LAN Event followed by a signal high LAN Event.
- Selecting “Fall” causes the instrument to trigger on the receipt of a signal high LAN Event followed by a signal low LAN Event.
- Selecting “High” causes the instrument to trigger on every signal high LAN Event.
- Selecting “Low” causes the instrument to trigger on every signal low LAN Event.

Remote Command:	`:LXI:EVENt:INPut:LAN[:SET]:DETection “LANEVENT”, HIGH|LOW|RISE|FALL`
Example:	:LXI:EVENt:INP:LAN:DET “LANEVENT”,HIGH
Notes:	If a non existent LAN event is passed in the lanEvent argument, the command is ignored
Preset:	HIGH
Preset:	Not affected by a Preset. The default value of "HIGH" can be restored by using the remote command: :SYSTem:DEFault INPut
State Saved:	Saved in instrument state.
Range:	HIGH | LOW | RISE | FALL
Readback Text:	Currently selected detection type
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:LXI:EVENt:INPut:LAN[:SET]:DETection? “LANEVENT”`
Example:	:LXI:EVEN:INP:LAN:DET? “LANEVENT”
Notes:	If a non existent LAN event is passed in the lanEvent argument, the command is ignored
Preset:	HIGH
State Saved:	Saved in instrument state.
Range:	HIGH | LOW | RISE | FALL
Readback Text:	Currently selected detection type
Initial S/W Revision:	Prior to A.02.00

Enabled (Remote Command Only)

When the Enabled parameter is set to ON, receiving the given LAN Event causes the instrument to transition to the state held in the Next State Slot.

When the Enabled parameter is OFF, the Input LAN Event is ignored.

Remote Command:	`:LXI:EVENt:INPut:LAN[:SET]:ENABled "LANEVENT",ON|OFF|1|0`
Example:	:LXI:EVEN:INP:LAN:ENAB “LAN0”,1
Preset:	OFF
Preset:	Not affected by a Preset. The default value of "OFF" can be restored by using the remote command: :SYSTem:DEFault INPut
State Saved:	Saved in instrument state.
Range:	1|0
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:LXI:EVENt:INPut:LAN[:SET]:ENABled? "LANEVENT"`
Example:	:LXI:EVEN:INP:LAN:ENAB? “LAN0”
Preset:	OFF
State Saved:	Saved in instrument state.
Range:	1|0
Initial S/W Revision:	Prior to A.02.00

Count (Remote Command Only)

Returns the number of items in the LXI Input LAN Event List.

Remote Command:	`:LXI:EVENt:INPut:LAN:COUNt?`
Example:	:LXI:EVEN:INP:LAN:COUN?
Initial S/W Revision:	Prior to A.02.00

List (Remote Command Only)

Returns a list of all of the valid LXI Input LAN Event names.

Remote Command:	`:LXI:EVENt:INPut:LAN:LIST?`
Example:	:LXI:EVEN:INP:LAN:LIST? Returns “LAN0”, “LAN1”, “LAN2”, “LAN3”, “LAN4”, “LAN5”, “LAN6”, “LAN7”
Preset:	“LAN0”, “LAN1”, “LAN2”, “LAN3”, “LAN4”, “LAN5”, “LAN6”, “LAN7”
State Saved:	Saved in instrument state.
Initial S/W Revision:	Prior to A.02.00

Configure (Remote Command Only)

Allows the configuration of some of the above parameters from a single SCPI command.

Remote Command:	:LXI:EVENt:INPut:LAN[:SET]:CONFigure "lanEvent" , <enab>, <detection>, <filter>, <identifier>
Example:	:LXI:EVEN:INP:LAN:CONF "LAN0",1,FALL,"FILTER","DEBUG"
Initial S/W Revision:	Prior to A.02.00

Restore Defaults

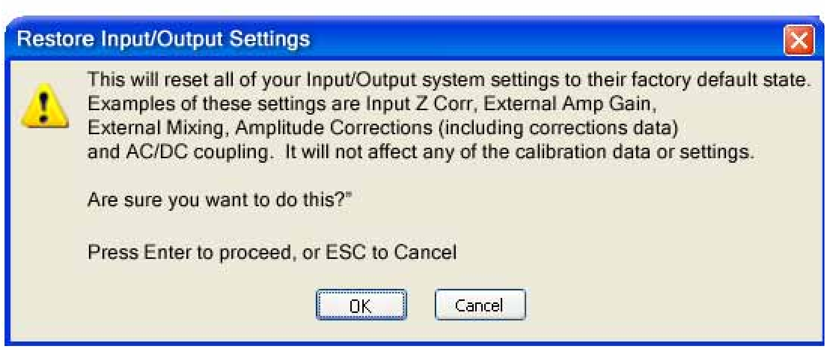
Provides incremental initialization of the system setting groups along with supporting a comprehensive reset of the entire instrument back to a factory default state. The menu selections are the groups of system settings and when one is selected, that particular group of system settings is reset back to their default values.

Key Path	**System**
Mode	All
Remote Command	:SYSTem:DEFault [ALL]|ALIGn|INPut|MISC|MODes|PON
Example	SYST:DEF
State Saved	No
Initial S/W Revision	Prior to A.02.00

Restore Input/Output Defaults

Causes the group of settings and data associated with Input/Output front-panel key to be a reset to their default values. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch. .

Confirmation is required to restore the Input/Output setting. The confirmation dialog is:



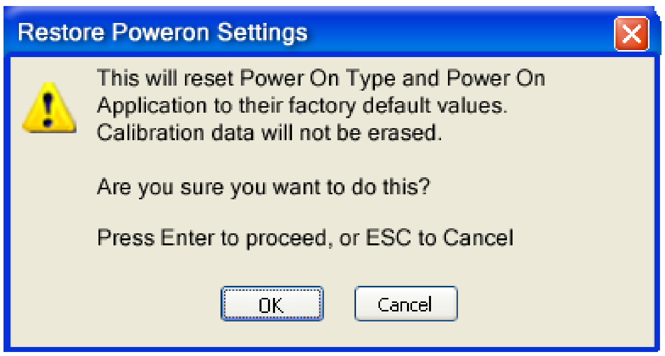
Key Path	**System, Restore System Defaults**

Example	:SYST:DEF INP
Initial S/W Revision	Prior to A.02.00

Restore Power On Defaults

This selection causes the Power On settings to be a reset to their default value. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch. The Power On settings and their default values are Power On Type reset to Mode and Input/Output Defaults and Power On Application reset to whatever the factory set as its default value.

Confirmation is required to restore the factory default values. The confirmation dialog is:



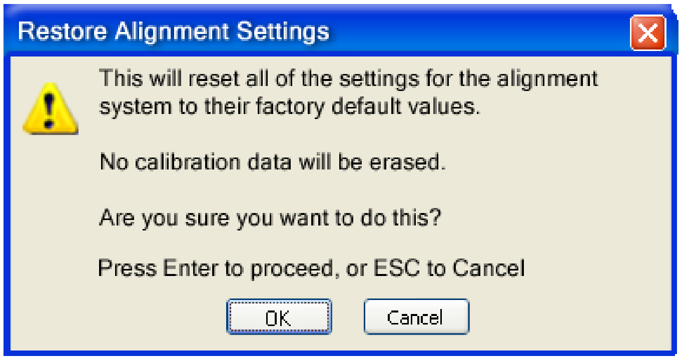
Key Path	**System, Restore System Defaults**
Example	:SYST:DEF PON
Initial S/W Revision	Prior to A.02.00

Restore Align Defaults

This selection causes the Alignment system settings to be a reset to their default values. This does not affect any Alignment data stored in the system. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

Confirmation is required to restore the factory default values. The confirmation dialog is:



Key Path	**System, Restore System Defaults**
Example	:SYST:DEF ALIG
Initial S/W Revision	Prior to A.02.00

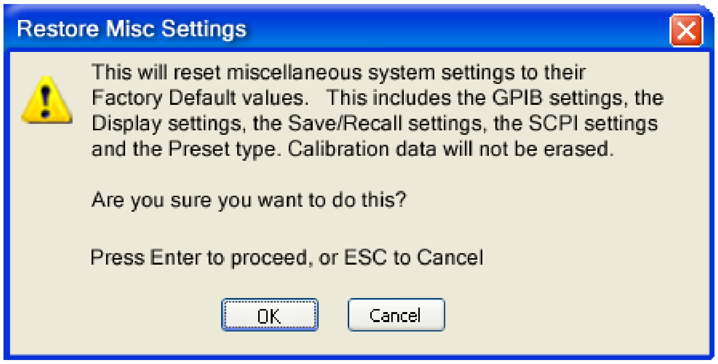
Restore Misc Defaults

This selection causes miscellaneous system settings to be reset to their default values. With this reset, you lose the GPIB address and it is reset to 18, so this should be used with caution. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch. This miscellaneous group contains the rest of the settings that have not been part of the other Restore System Defaults groups. The following table is a complete list of settings associated with this group:

Miscellaneous Setting	Default Value
Verbose SCPI	Off
GPIB Address	18
Auto File Name Number	000
Save Type	State
State Save To	Register 1
Screen Save To	SCREEN000.png
DISP:ENABle	ON
Full Screen	Off
SCPI Telnet	ON
SCPI Socket	ON
SICL Server	ON
Display Intensity	100
Display Backlight	ON
Display Theme	TDColor

System Annotation	ON
The SYST:PRES:TYPE	MODE

Confirmation is required to restore the factory default values. The confirmation dialog is:

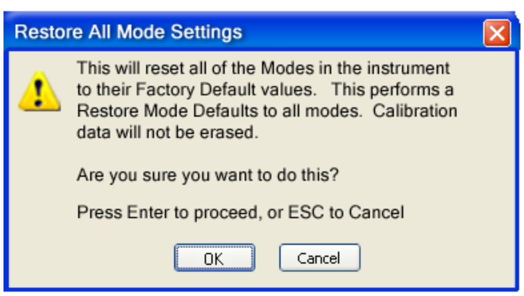


Key Path	**System, Restore System Defaults**
Example	:SYST:DEF MISC
Initial S/W Revision	Prior to A.02.00

Restore Mode Defaults (All Modes)

This selection resets all of the modes in the instrument back to their default state just as a Restore Mode Defaults does and it switches the instrument to the power-on mode and causes the default measurement for the power-on mode to be active. This level of Restore System Defaults does not affect any system settings, but it does affect the state of all modes and does cause a mode switch unless the instrument was already in the power-on mode.

Confirmation is required to restore the factory default values. The confirmation dialog is:



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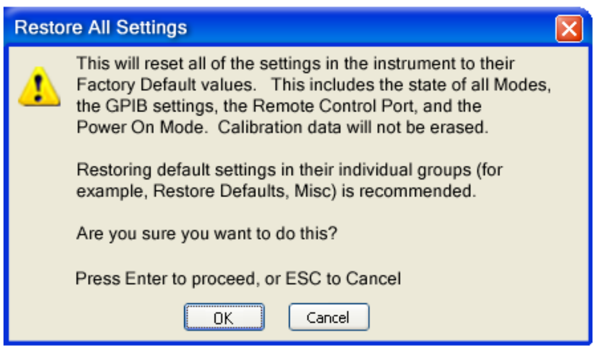
Key Path	**System, Restore System Defaults**
Example	:SYST:DEF MOD

Couplings	An All Mode will cause the currently running measurement to be aborted, mode switch to the power-on mode and activate the default measurement for the power-on mode.. It gets the mode to a consistent state with all of the default couplings set.
Initial S/W Revision	Prior to A.02.00

All

This is the catastrophic function that does a comprehensive reset of ALL analyzer settings to their factory default values. It resets all of the system setting groups, causes a Restore Mode Defaults for all modes in the instrument, and switches back to the power-on mode. It does not affect the User Preset file or any user saved files.

Confirmation is required to restore the factory default values. The confirmation dialog is:



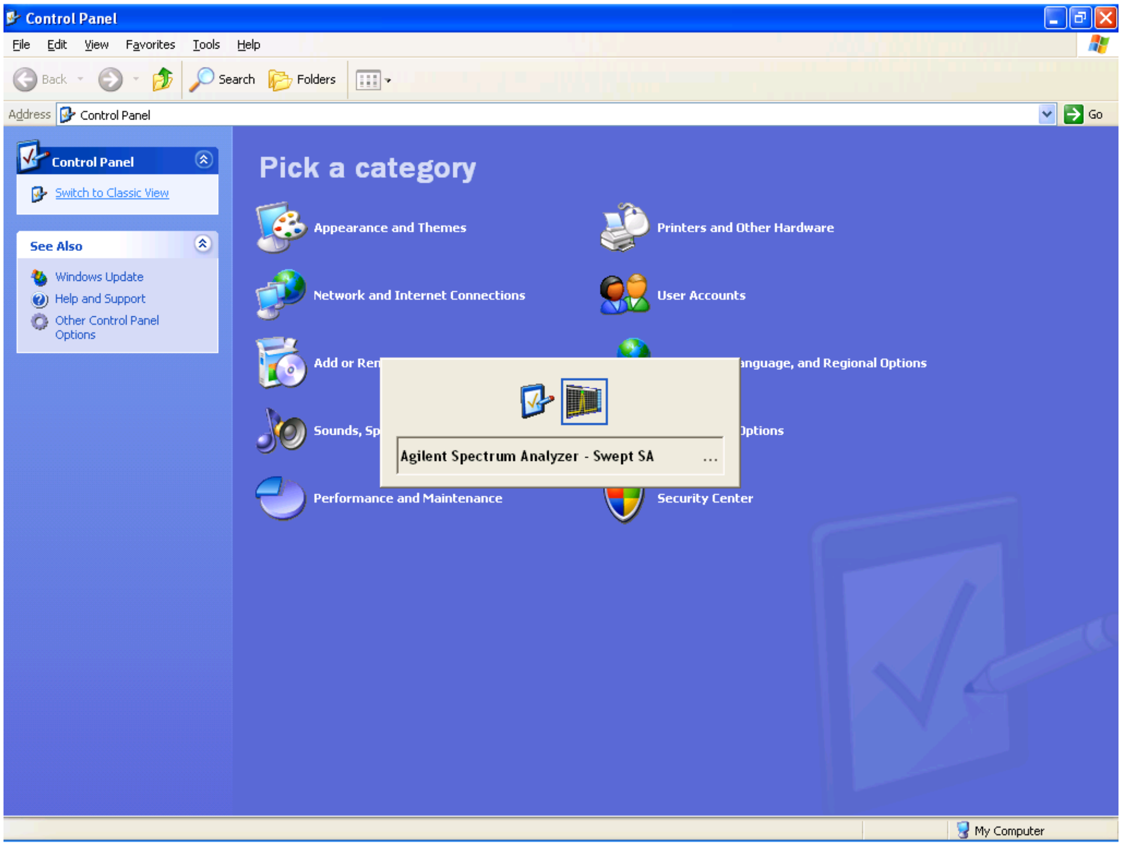
Key Path	**System, Restore System Defaults**
Example	:SYST:DEF ALL
Couplings	An All will cause the currently running measurement to be aborted and get all modes to a consistent state, so it is unnecessary to couple any settings.
Initial S/W Revision	Prior to A.02.00

Control Panel…

Opens the Windows Control Panel. The Control Panel is used to configure certain elements of Windows that are not configured through the hardkey/softkey System menus.

The Control Panel is a separate Windows application, so to return to the analyzer once you are in the Control Panel, you may either:

Exit the Control Panel by clicking on the red X in the upper right hand corner, with a mouse



Or use Alt-Tab: press and hold the Alt 

key and press and release the Tab key until the Analyzer logo is showing in the window in the center of the screen, as above, then release the Alt key.

Key Path	**System**
Notes	No remote command for this key.
Initial S/W Revision	Prior to A.02.00

Licensing…

Opens the license explorer.

For Help on this key, select Help in the menu bar at the top of the license explorer window.

Key Path	**System**
Notes	No equivalent remote command for this key.
Initial S/W Revision	Prior to A.02.00

Remote Command:	`:SYSTem:LKEY <”OptionInfo”>, <”LicenseInfo”>`

Example:	SYST:LKEY “N9073A–1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1 017638211AC9F60D9C639FE539735909C551DE0A91”
Notes:	The <”OptionInfo”> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, since the system knows which version is supported for each feature. The <”LicenseInfo”> contains the signature, the expiration date, and serial number for transport if transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the serial number, the system regards it as non-transportable. As a result, this supports backward compatibility.
Initial S/W Revision:	Prior to A.02.00

Remote Command:	:SYSTem:LKEY:DELete <”OptionInfo”>,<”LicenseInfo”>
Example:	SYST:LKEY:DEL “N9073A–1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1 017638211AC9F60D9C639FE539735909C551DE0A91”
Notes:	The <”OptionInfo”> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, if more than one version is installed. The <”LicenseInfo”> contains the signature, the expiration date, and whether or not be transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the transportability, the system regards it as non-transportable. As a result, this supports backward compatibility.
Initial S/W Revision:	Prior to A.02.00

Remote Command:	:SYSTem:LKEY:LIST?

Notes:	Return Value: An <arbitrary block data> of all the installed instrument licenses. The format of each license is as follows. <Feature>,<Version>,<Signature>,<Expiration Date>,<Serial Number for Transport> Return Value Example: #3136 N9073A–1FP,1.000,B043920A51CA N9060A–2FP,1.000,4D1D1164BE64 N9020A–508,1.000,389BC042F920 N9073A–1F1,1.000,5D71E9BA814C,13-aug–2005 <arbitrary block data> is: #NMMM<data> Where: N is the number of digits that describes the number of MMM characters. For example if the data was 55 bytes, N would be 2. MMM would be the ASCII representation of the number of bytes. In the previous example, N would be 55. <data> ASCII contents of the data
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:SYSTem:LKEY? <"OptionInfo">`
Example:	SYST:LKEY? “N9073A–1FP”
Notes:	The <”OptionInfo”> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one. Return Value: <”LicenseInfo”> if the license is valid, null otherwise. <”LicenseInfo”> contains the signature, the expiration date, and serial number if transportable. Return Value Example: “B043920A51CA”
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:SYSTem:HID?`
Notes:	Return value is the host ID as a string
Initial S/W Revision:	Prior to A.02.00

Security

Accesses capabilities for operating the instrument in a security controlled environment.

Key Path	**System**
Initial S/W Revision	PXA.01.01

USB

The Windows operating system can be configured to disable write access to the USB ports for users who are in a secure environment where transferring data from the instrument is prohibited. This user interface is a convenient way for the customer to disable write access to USB.

Key Path	**System, Security**
Mode	All
Scope	Mode Global
Remote Command	`:SYSTem:SECurity:USB:WPRotect[:ENABle] ON|OFF|0|1` `:SYSTem:SECurity:USB:WPRotect[:ENABle]?`
Example	:SYST:SEC:USB:WPR ON ! Will set USB ports to Read-only
Notes	When the USB ports are in Read-only mode then no data can be stored to USB, including the internal USB memory used for a back-up location for the calibration data.
Dependencies	This key is grayed-out unless the current user has administrator privileges.
Preset	This is unaffected by Preset or any Restore System Defaults. An Agilent Recovery will set the USB to write protect OFF
State Saved	No
Range	Read-Write|Read only
Key Path	3664
Initial S/W Revision	PXA.01.01

Read-Write

Selection for allowing full read-write access to the USB ports.

Key Path	**System, Security, USB**
Example	:SYST:SEC:USB:WPR OFF ! Will set USB ports to Read-Write
Initial S/W Revision	PXA.01.01

Read only

Selection for disabling write access to the USB ports.

Key Path	**System, Security, USB**
Example	:SYST:SEC:USB:WPR ON ! Will set USB ports to Read only
Initial S/W Revision	PXA.01.01

Diagnostics

The Diagnostics key in the System menu gives you access to basic diagnostic capabilities of the instrument.

Key Path	**System**
Initial S/W Revision	Prior to A.02.00

Show Hardware Statistics

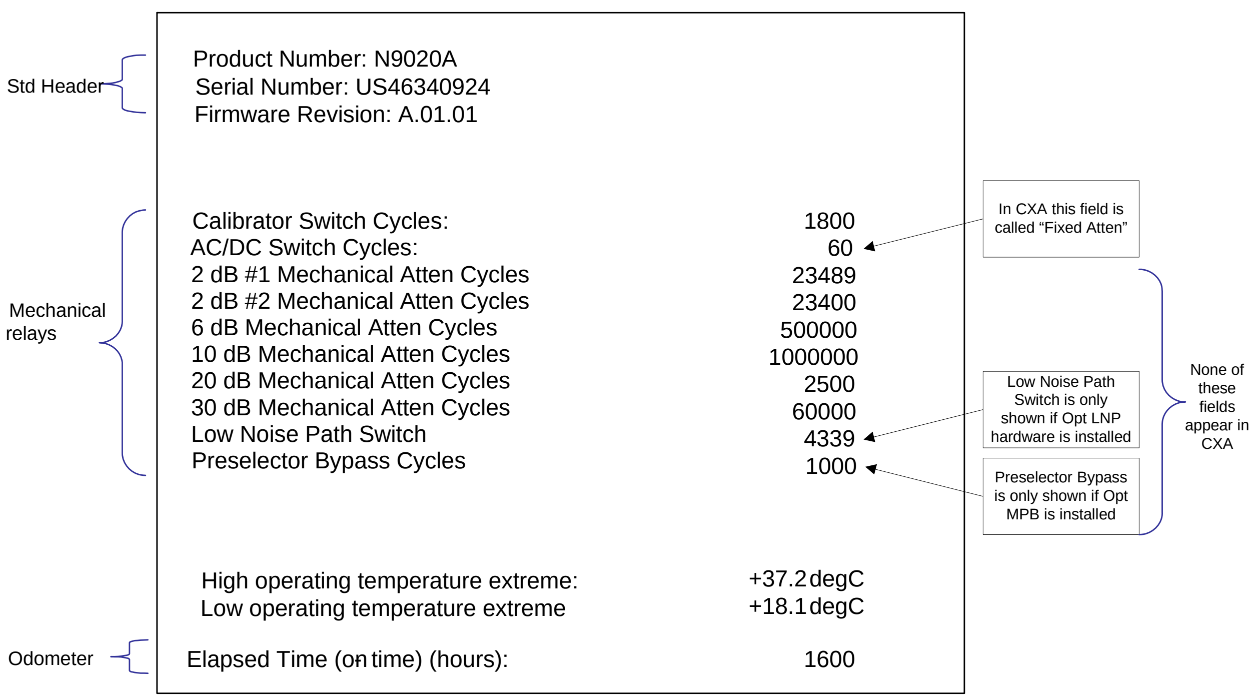
Provides a display of various hardware statistics. The statistics include the following:

Mechanical relay cycles

High and Low temperature extremes

Elapsed time that the instrument has been powered-on (odometer)

The display should appear listing the statistics, product number, serial number, and firmware revision.



The data will be updated only when the Show Hardware Statistics menu key is pressed, it will not be updated while the screen is displayed.

The tabular data should be directly printable.

Key Path	**System, Diagnostics**
Mode	All
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed.
Initial S/W Revision	Prior to A.02.00

SCPI for Show Hardware Statistics (Remote Commands Only)

Each of the hardware statistic items can be queriedvia SCPI.

- "Query the Mechanical Relay Cycle Count" on page 270
- "Query the Operating Temperature Extremes" on page 270
- "Query the Elapsed Time since 1st power on" on page 271

Query the Mechanical Relay Cycle Count

Returns the count of mechanical relay cycles.

Remote Command:	`:SYSTem:MRELay:COUNt?`
Example:	:SYST:MREL:COUN?
Notes:	Query Only The return value is a comma separated list of the individual counts for each mechanical relay. The position of the relays in the list is: "<Cal Signal>,<AC/DC>,<2dB #1 Atten>,<2dB #2 Atten>,<6dB Atten>,<10dB Atten>,<20dB Atten>,<30dB Atten>,<Fixed Atten>,<Low Noise Path Switch>,<Presel Bypass>" Items in the list not pertaining to your particular hardware configuration will return as –999 for those items.
Initial S/W Revision:	Prior to A.02.00
Modified at S/W Revision:	A.03.00, A.04.00

Query the Operating Temperature Extremes

Returns the low operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Mode	All
Remote Command	`:SYSTem:TEMPerature:LEXTreme?`
Example	:SYST:TEMP:LEXT?

Notes	Value is in degrees Celsius at which the lowest operating temperature has been recorded since 1st power-up.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Mode	All
Remote Command	`:SYSTem:TEMPerature:HEXTreme?`
Example	:SYST:TEMP:HEXT?
Notes	Value is in degrees Celsius at which the highest operating temperature has been recorded since 1st power-up.
State Saved	No
Initial S/W Revision	Prior to A.02.00

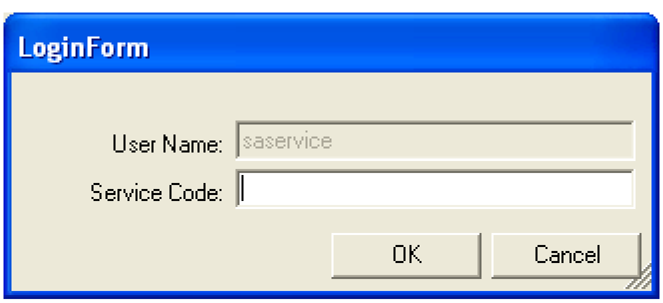
Query the Elapsed Time since 1st power on

Returns the elapsed on-time in minutes since 1st power-on.

Remote Command:	`:SYSTem:PON:ETIMe?`
Example:	:SYST:PON:ETIM?
Notes:	Query Only
Initial S/W Revision:	Prior to A.02.00

Advanced

Accesses advanced diagnostic capabilities performed in the factory or under instructions from repair procedures. This menu key is only visible when the logged-in user is “saservice”. The first access to the Advanced Diagnostic Menu after invoking the instrument application will require an authentication, which is to enter the Service Code. Subsequent accesses to the Advanced Diagnostic Menu are unimpeded. The Authentication dialog looks like:



“OK” is the default key thus the Enter key is used to complete the entry. If invalid Service Code is entered authentication is not granted and you are provided the following dialog:

Key Path	**System, Diagnostics**
Notes	**Password is required to access this menu.**
Initial S/W Revision	**Prior to A.02.00**

Service

Accesses capabilities performed in the factory or under instructions from repair procedures. This menu key is only visible when the logged-in user is “advanceduser” or “saservice”. The first access to the Service Menu after invoking the instrument application will require an authentication Service Code.

Key Path	**System**
Initial S/W Revision	Prior to A.02.00

System Remote Commands (Remote Commands Only)

The commands in this section have no front panel key equivalent

Initial S/W Revision:	Prior to A.02.00

List installed Options (Remote Command Only)

Lists the installed options that pertain to the instrument (signal analyzer). .

Mode	All
Remote Command	`:SYSTem:OPTions?`
Example	:SYST:OPT?
Notes	The return string is a comma separated list of the installed options. For example: “503,P03,PFR” :SYSTem:OPTions? and *OPT? are the same.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Lock the Front-panel keys (Remote Command Only)

Disables the instrument keyboard to prevent local input when the instrument is controlled remotely. Annunciation showing a "K" for 'Klock" (keyboard lock) alerts the local user that the keyboard is locked. Klock is similar to the GPIB Local Lockout function; namely that no front-panel keys are active with the exception of the Power Standby key. (The instrument is allowed to be turned-off if Klock is ON.) The Klock command is used in remote control situations where Local Lockout cannot be used.

Although primary intent of Klock is to lock-out the front panel, it will lock-out externally connected keyboards through USB. Klock has no effect on externally connected pointing devices (mice).

The front panel 'Local' key (Cancel/Esc) has no effect if Klock is ON.

Mode	All
Remote Command	:SYSTem:KLOCk OFF|ON|0|1 :SYSTem:KLOCk?
Example	:SYST:KLOC ON
Notes	Keyboard lock remains in effect until turned-off or the instrument is power-cycled
Preset	Initialized to OFF at startup, unaffected by Preset
State Saved	No
Initial S/W Revision	Prior to A.02.00

List SCPI Commands (Remote Command Only)

Outputs a list of the valid SCPI commands for the currently selected Mode.

Remote Command:	:SYSTem:HELP:HEADers?
Example:	:SYST:HELP:HEAD?
Notes:	The output is an IEEE Block format with each command separated with the New-Line character (hex 0x0A)
Initial S/W Revision:	Prior to A.02.00

SCPI Version Query (Remote Command Only)

Returns the SCPI version number with which the instrument complies. The SCPI industry standard changes regularly. This command indicates the version used when the instrument SCPI commands were defined.

Remote Command:	:SYSTem:VERSion?
Example:	:SYST:VERS?
Initial S/W Revision:	Prior to A.02.00

Date (Remote Command Only)

The recommended access to the Date, Time, and Time zone of the instrument is through the Windows native control (Control Panel or accessing the Task Bar). You may also access this information remotely, as shown in this command and Time (below).

Sets or queries the date in the instrument.

Mode	All
Remote Command	`:SYSTem:DATE "<year>,<month>,<day>"` `:SYSTem:DATE?`
Example	:SYST:DATE “2006,05,26”
Notes	<year> is the four digit representation of year. (for example, 2006) <month> is the two digit representation of year. (for example. 01 to 12) <day> is the two digit representation of day. (for example, 01 to 28, 29, 30, or 31) depending on the month and year
Initial S/W Revision	Prior to A.02.00

Time (Remote Command Only)

Sets or queries the time in the instrument.

Mode	All
Remote Command	`:SYSTem:TIME "<hour>,<minute>,<second>"` `:SYSTem:TIME?`
Example	:SYST:TIME “13,05,26”
Notes	<hour> is the two digit representation of the hour in 24 hour format <minute> is the two digit representation of minute <second> is the two digit representation of second
Initial S/W Revision	Prior to A.02.00

User Preset

Accesses a menu that gives you the following three choices:

User Preset – recalls a state previously saved using the **Save User Preset** function.

User Preset All Modes – presets all of the modes in the analyzer

Save User Preset – saves the current state for the current mode

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

User Preset

User Preset sets the state of the currently active mode back to the state that was previously saved for this mode using the **Save User Preset** menu key or the SCPI command, SYST:PRES:USER:SAV. It not only recalls theMode Preset settings, but it also recalls all of the mode persistent settings, and the Input/Outpit system setting that existed at the time **Save User Preset** was executed.

If a **Save User Preset** has not been done at any time, **User Preset** recalls the default user preset file for the currently active mode. The default user preset files are created if, at power-on, a mode detects there is no user preset file. There will never be a scenario when there is no user preset file to restore. For each mode, the default user preset state is the same state that would be saved if a **Save User Preset** is performed in each mode right after doing a Restore Mode Default and after a Restore Input/Output Defaults.

The User Preset function does the following:

- Aborts the currently running measurement.
- Sets the mode State to the values defined by **Save User Preset**.
- Makes the saved measurement for the currently running mode the active measurement.
- Brings up the saved menu for the power-on mode.
- Clears the input and output buffers.
- Sets the Status Byte to 0.

Key Path	**User Preset**
Remote Command	`:SYSTem:PRESet:USER`
Example	:SYST:PRES:USER:SAVE :SYST:PRES:USER

Notes	:SYST:PRES:USER:SAVE is used to save the current state as the user preset state. Clears all pending OPC bits. The Status Byte is set to 0. Pressing the User Preset front-panel key while already in the User Preset menu will cause the User Preset to get executed
Couplings	A user preset will cause the currently running measurement to be aborted and cause the saved measurement to be active. Recalling a User Preset file has the same issues that recalling a Save State file has. Some settings may need to be limited and therefore re-coupled, since the capabilities of the mode may have changes when the User Preset file was last saved.
Initial S/W Revision	Prior to A.02.00

User Preset All Modes

Recalls all of the User Preset files for each mode, switches to the power-on mode, and activates the saved measurement from the power-on mode User Preset file.

NOTE When the instrument is secured, all of the user preset files are converted back to their default user preset files.

The User Preset function does the following:

- Aborts the currently running measurement.
- Switches the Mode to the power-on mode.
- Restores the User Preset files for each mode.
- Makes the saved measurement for the power-on mode the active measurement.
- Brings up the saved menu for the power-on mode.
- Clears the input and output buffers.
- Sets the Status Byte to 0.

Key Path	**User Preset**
Remote Command	`:SYSTem:PRESet:USER:ALL`
Example	:SYST:PRES:USER:SAVE :SYST:PRES:USER:ALL
Notes	Clears all pending OPC bits. The Status Byte is set to 0. :SYST:PRES:USER:SAVE is used to save the current state as the user preset state.

Couplings	A user preset will cause the currently running measurement to be aborted, cause a mode switch to the power-on mode, and cause the saved measurement to be active in the power-on mode. Recalling a User Preset file has the same issues that recalling a Save State file has. Some settings may need to be limited and therefore re-coupled, since the capabilities of the mode may have changes when the User Preset file was last saved.
Initial S/W Revision	Prior to A.02.00

Save User Preset

Saves the currently active mode and its State. You can recall this User Preset file by pressing the User Preset menu key or sending the SYST:PRES:USER remote command. This same state is also saved by the Save State function.

Key Path	**User Preset**
Remote Command	`:SYSTem:PRESet:USER:SAVE`
Example	:SYST:PRES:USER:SAVE
Notes	:SYST:PRES:SAVE creates the same file as if the user requested a *SAV or a MMEM: STOR:STAT, except User Preset Save does not allow the user to specify the filename or the location of the file.
Initial S/W Revision	Prior to A.02.00

6 Programming the Analyzer

This chapter provides introductory information about the programming documentation included with your product.

What Programming Information is Available?

The X-Series Documentation can be accessed through the Additional Documentation page in the instrument Help system and is included on the Documentation CD shipped with the instrument. It can also be found in the instrument at: `C:\ProgramsFiles\Agilent\SignalAnalysis\Infrastructure\Help\otherdocs`, or online at: http://www.agilent.com/find/mxa_manuals.

The following resources are available to help you create programs for automating your X-Series measurements:

Resource	Description
X-Series Programmer's Guide	Provides general SCPI programming information on the following topics: • Programming the X-Series Applications • Programming fundamentals • Programming examples Note that SCPI command descriptions for measurement applications are NOT in this book, but are in the User's and Programmer's Reference.
User's and Programmer's Reference manuals	Describes all front-panel keys and softkeys, including SCPI commands for a measurement application. Note that: • Each measurement application has its own User's and Programmer's Reference. • The content in this manual is duplicated in the analyzer's Help (the Help that you see for a key is identical to what you see in this manual).
Embedded Help in your instrument	Describes all front-panel keys and softkeys, including SCPI commands, for a measurement application. Note that the content that you see in Help when you press a key is identical to what you see in the User's and Programmer's Reference.
X-Series Getting Started Guide	Provides valuable sections related to programming including: • Licensing New Measurement Application Software - After Initial Purchase • Configuring instrument LAN Hostname, IP Address, and Gateway Address • Using the Windows XP Remote Desktop to connect to the instrument remotely • Using the Embedded Web Server Telnet connection to communicate SCPI This printed document is shipped with the instrument.
Agilent Application Notes	Printable PDF versions of pertinent application notes.
Agilent VISA User's Guide	Describes the Agilent Virtual Instrument Software Architecture (VISA) library and shows how to use it to develop I/O applications and instrument drivers on Windows PCs.

IEEE Common GPIB Commands

Numeric values for bit patterns can be entered using decimal or hexi-decimal representations. (that is,. 0 to 32767 is equivalent to #H0 to #H7FFF).

Calibration Query

*CAL? Performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful. A one is returned if any part of the alignment fails. The equivalent SCPI command is CALibrate[:ALL]?

See "Alignments" on page 193 for details of *CAL?.

Clear Status

Clears the status byte register. It does this by emptying the error queue and clearing all bits in all of the event registers. The status byte register summarizes the states of the other registers. It is also responsible for generating service requests.

Key Path	**No equivalent key. Related key System, Show Errors, Clear Error Queue**
Remote Command	`*CLS`
Example	*CLS Clears the error queue and the Status Byte Register.
Notes	For related commands, see the SYSTem:ERRor[:NEXT]? command. See also the STATus:PRESet command and all commands in the STATus subsystem.
Status Bits/OPC dependencies	Resets all bits in all event registers to 0, which resets all the status byte register bits to 0 also.
Initial S/W Revision	Prior to A.02.00

Standard Event Status Enable

Selects the desired bits from the standard event status enable register. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device dependent error, status execution error, command error, and power on. The selected bits are OR'd to become a summary bit (bit 5) in the byte register which can be queried.

The query returns the state of the standard event status enable register.

Key Path	**No equivalent key. Related key System, Show Errors, Clear Error Queue**
Remote Command	`*ESE <integer>` `*ESE?`

Example	*ESE 36 Enables the Standard Event Status Register to monitor query and command errors (bits 2 and 5). *ESE? Returns a 36 indicating that the query and command status bits are enabled.
Notes	For related commands, see the STATus subsystem and SYSTem:ERRor[:NEXT]? commands.
Preset	255
State Saved	Not saved in state.
Min	0
Max	255
Status Bits/OPC dependencies	Event Enable Register of the Standard Event Status Register.
Initial S/W Revision	Prior to A.02.00

Standard Event Status Register Query

Queries and clears the standard event status event register. (This is a destructive read.) The value returned is a hexadecimal number that reflects the current state (0/1) of all the bits in the register.

Remote Command:	`*ESR?`
Example:	*ESR? Returns a 1 if there is either a query or command error, otherwise it returns a zero.
Notes:	For related commands, see the `STATus` subsystem commands.
Preset:	0
Min:	0
Max:	255
Status Bits/OPC dependencies:	Standard Event Status Register (bits 0 – 7).
Initial S/W Revision:	Prior to A.02.00

Identification Query

Returns a string of instrument identification information. The string will contain the model number, serial number, and firmware revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

- Manufacturer
- Model
- Serial number

- Firmware version

Key Path	**No equivalent key. See related key System, Show System.**
Remote Command	`*IDN?`
Example	*IDN? Returns instrument identification information, such as: Agilent Technologies,N9020A,US01020004,A.01.02
Initial S/W Revision	Prior to A.02.00

Instrument Model Number

ID? - Returns a string of the instrument identification. The string will contain the model number.

When in Remote Language compatibility mode the query will return the model number of the emulated instrument, when in any other mode the returned model number will be that of the actual hardware.

Operation Complete

The *OPC command sets bit 0 in the standard event status register (SER) to “1” when pending operations have finished, that is when all overlapped commands are complete. It does not hold off subsequent operations. You can determine when the overlapped commands have completed either by polling the OPC bit in SER, or by setting up the status system such that a service request (SRQ) is asserted when the OPC bit is set.

The *OPC? query returns a “1” after all the current overlapped commands are complete. So it holds off subsequent commands until the "1” is returned, then the program continues. This query can be used to synchronize events of other instruments on the external bus.

Remote Command:	`*OPC` `*OPC?`
Example:	INIT:CONT 0 Selects single sweeping. INIT:IMM Initiates a sweep. *OPC? Holds off any further commands until the sweep is complete.
Status Bits/OPC dependencies:	Not global to all remote ports or front panel. *OPC only considers operation that was initiated on the same port as the *OPC command was issued from. *OPC is an overlapped command, but *OPC? is sequential.
Initial S/W Revision:	Prior to A.02.00

Query Instrument Options

Returns a string of all the installed instrument options. It is a comma separated list with quotes, such as: “503,P03,PFR”.

To be IEEE compliant, this command should return an arbitrary ascii variable that would not begin and end with quotes. But the quotes are needed to be backward compatible with previous SA products and software. So, the actual implementation will use arbitrary ascii. But quotes will be sent as the first and last ascii characters that are sent with the comma-separated option list.

Remote Command:	`*OPT?`
Initial S/W Revision:	Prior to A.02.00

Recall Instrument State

This command recalls the instrument state from the specified instrument memory register.

- If the state being loaded has a newer firmware revision than the revision of the instrument, no state is recalled and an error is reported.
- If the state being loaded has an equal firmware revision than the revision of the instrument, the state will be loaded.
- If the state being loaded has an older firmware revision than the revision of the instrument, the instrument will only load the parts of the state that apply to the older revision.

Remote Command:	`*RCL <register #>`
Example:	*RCL 7 Recalls the instrument state that is currently stored in register 7.
Notes:	Registers 0 through 6 are accessible from the front panel in menu keys for Recall Registers.
Min:	0
Max:	127
Status Bits/OPC dependencies:	The command is sequential.
Initial S/W Revision:	Prior to A.02.00

Save Instrument State

This command saves the current instrument state and mode to the specified instrument memory register.

Remote Command:	`*SAV <register #>`
Example:	*SAV 9 Saves the instrument state in register 9.
Notes:	Registers 0 through 6 are accessible from the front panel in menu keys for Save Registers.
Min:	0
Max:	127
Status Bits/OPC dependencies:	The command is sequential.
Initial S/W Revision:	Prior to A.02.00

Service Request Enable

This command enables the desired bits of the service request enable register.

The query returns the value of the register, indicating which bits are currently enabled.

Remote Command:	`*SRE <integer>` `*SRE?`
Example:	*SRE 22 Enables bits 1, 2, and 4 in the service request enable register.
Notes:	For related commands, see the STATus subsystem and SYSTem:ERRor[:NEXT]? commands.
Preset:	0
Min:	0
Max:	255
Status Bits/OPC dependencies:	Service Request Enable Register (all bits, 0 – 7).
Initial S/W Revision:	Prior to A.02.00

Status Byte Query

Returns the value of the status byte register without erasing its contents.

Remote Command:	`*STB?`
Example:	*STB? Returns a decimal value for the bits in the status byte register. For example, if a 16 is returned, it indicates that bit 5 is set and one of the conditions monitored in the standard event status register is set.
Notes:	See related command *CLS.
Status Bits/OPC dependencies:	Status Byte Register (all bits, 0 – 7).
Initial S/W Revision:	Prior to A.02.00

Trigger

This command triggers the instrument. Use the :TRIGger[:SEQuence]:SOURce command to select the trigger source.

Key Path	**No equivalent key. See related keys Single and Restart.**
Remote Command	`*TRG`
Example	*TRG Triggers the instrument to take a sweep or start a measurement, depending on the current instrument settings.
Notes	See related command :INITiate:IMMediate.
Initial S/W Revision	Prior to A.02.00

Self Test Query

This query performs the internal self-test routines and returns a number indicating the success of the testing. A zero is returned if the test is successful, 1 if it fails.

Remote Command:	`*TST?`
Example:	*TST? Runs the self-test routines and returns 0=passed, 1=some part failed.
Initial S/W Revision:	Prior to A.02.00

Wait-to-Continue

This command causes the instrument to wait until all overlapped commands are completed before executing any additional commands. There is no query form for the command.

Remote Command:	`*WAI`
Example:	INIT:CONT OFF; INIT;*WAI Sets the instrument to single sweep. Starts a sweep and waits for its completion.
Status Bits/OPC dependencies:	Not global to all remote ports or front panel. *OPC only considers operation that was initiated on the same port as the *OPC command was issued from.
Initial S/W Revision:	Prior to A.02.00

7 Vector Analysis

The Vector Analysis measurement is accessed from the Meas hardkey.The Vector Analysis measurement bases its results on a set of periodic time samples of a channel. The channel is defined by a combined bank of hardware and DSP filters whose overall frequency response has a flat top and steep rolloff at the band edges. The time record is operated upon by a number of mathematical functions, including the FFT to produce spectrum results and statistical functions, including complementary cumulative distribution function (CCDF). Any of these results may be displayed in a flexible layout, with the Y data formatted in a variety of ways, and results scaled as desired. Many of these analysis results are also available in optional VSA demodulation measurements. For measurement results and views, see “View/Display” on page 311.

This topic contains the following sections:

Remote Command Results for Vector Analysis Measurement

The Vector Analysis measurement is invoked remotely by the following:

`:CONFigure:VECTor`

`:CONFigure:VECTor:NDEFault`

Remote results may be obtained using the following:

`:FETCh:VECTor[n]?`

Only table results may be obtained using FETCh. The tables available for the Vector Analysis measurement are ACP and OccBW tables, which are available to any VSA measurement.

`:INITiate:VECTor`

`:READ:VECTor[n]?`

NOTE	The MEASure? command is not supported by the Vector Analysis measurement.

For more information and remote commands, see “Remote SCPI Commands and Data Queries” on page 482 in the section, “Common Measurement Functions 2”.

Also see “Data” on page 430 in the section “Common Measurement Functions 2” for more measurement SCPI commands.

Front Panel Results

Vector Analysis results may be displayed in any trace, and the traces viewed in a variety of layouts that show 1, 2, 3, or 4 traces at a time. Each trace may be scaled as desired regardless of measurement settings, or auto-scaled to reflect measurement settings. Data may be formatted in a variety of ways. (For example, you may view the log magnitude of complex data, the real or imaginary part, etc.) You may use View Presets to view frequently used results, or to provide a familiar starting point from which you may customize your own view.

Key Path	**Meas**
Mode	VSA

AMPTD Y Scale

See “AMPTD Y Scale (Amplitude)” on page 361 in the section "Common Measurement Functions 2" for for a description of this function.

Auto Couple

The Auto Couple key forces all Auto/Man functions into Auto. These include the following functions.

- Frequency Step
- X Scale
- Y Axis Unit Preference
- Frequency Points

NOTE

This function does not invoke the Auto tune function, nor does it cause any Y autoscaling or Input Auto ranging.

For more information, see "Auto Couple" on page 33 in the section "Common Measurement Functions".

Key Path	**Front Panel**
Mode	VSA

BW

See “BW (Bandwidth)” on page 368 in the section "Common Measurement Functions 2" for a description of this function.

Cont (Continuous)

See “Cont (Continuous Measurement/Sweep)” on page 35 in the section "Common Measurement Functions 1" for a description of this function.

FREQ Channel

See “FREQ Channel” on page 371 in the section "Common Measurement Functions 2" for a description of this function.

Input/Output

See “Input/Output” on page 43 in the section "Common Measurement Functions " for a description of this function.

Marker

See "Marker" on page 374 in the section "Common Measurement Functions 2" for a description of this function.

Marker Function

See “Marker Function” on page 392 in the section "Common Measurement Functions 2" for a description of this function.

Marker To

See “Marker -> (Marker To)” on page 390 in the section "Common Measurement Functions 2" for a description of this function.

Meas (Measure)

See “Meas” on page 155 in the section "Common Measurement Functions " for a description of this function.

Meas Setup

See “Meas Setup” on page 400 in the section "Common Measurement Functions 2" for a description of this function.

Avg Number

See “Avg Number” on page 400 in the section "Common Measurement Functions 2" for a description of this function.

Average Mode

See “Average Mode” on page 401 in the section "Common Measurement Functions 2" for a description of this function.

Average Setup

See “Average Setup” on page 402 in the section "Common Measurement Functions 2" for a description of this function.

Meas Preset

Returns parameters for this measurement to those set by the factory.

Key Path	**Meas Setup**
Mode	VXA
Remote Command	`:CONFigure:VECTor`
Example	CONF:VECT

Mode

See “Mode” on page 213in the section "Common Measurement Functions" for a description of this function.

Mode Setup

See "Mode Setup" on page 229 in the section "Common Measurement Functions" for a description of this function.

Peak Search

See “Peak Search” on page 406 in the section "Common Measurement Functions 2" for a description of this function.

Single

See “Single (Single Measurement/Sweep)” on page 263 in the section "Common Measurement Functions" for a description of this function.

Source

See “Source” on page 263 in the section "Common Measurement Functions" for a description of this function.

SPAN X Scale

See "SPAN X Scale" on page 416 in the section "Common Measurement Functions 2" for a description of this function.

Sweep/Control

See “Sweep/Control” on page 424 in the section "Common Measurement Functions 2" for a description of this function.

Trace/Detector

This section details the trace results accessible via the data key and also via SCPI, many of which are available in other measurements as well.

See “Trace/Detector” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

Select Trace

See “Select Trace” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

Data

This key provides a menu of trace data choices for the selected trace. For the SCPI command, and other details, see Trace/Detector, “Data” on page 430.

The following trace data results are available:

Trace data soft key name	SCPI string form	Description
Spectrum	"Spectrum1"	Averaged result of successive Inst Spectrum results (If RMS or Max averaging is on). Otherwise, FFT of current windowed Main (or Gate) Time
Inst Spectrum	"Inst Spec1"	Instantaneous Spectrum is the FFT of the current windowed Main (or Gate) Time. It is instantaneous in the sense that it isn't rms averaged, but it may included time-averaged data.
Main Time	"Main Time1"	Same as Inst Main Time unless Time averaging is on, in which case it is the averaged result of successive Inst Main Time results. If Time Gating is on, Main Time is the source to which the Gate is applied.
Inst Main Time	"Inst Main Time1"	Instantaneous Main Time is the current corrected, resampled, time record.
Gate Time	"Gate Time1"	Gate Time replaces Main Time as input to results if gating is on.
Raw Main Time	"Raw Main Time1"	Time record as it comes from the hardware, before software resampling or corrections
Power Spectral Density (PSD)	"PSD1"	Power spectrum divided by ResBW
CCDF	"CCDF1"	Complementary Cumulative Distribution Function of all time date since last measurement restart
CDF	"CDF1"	Cumulative Distribution Function of all time date since last measurement restart

Trace data soft key name	SCPI string form	Description
PDF	"PDF1"	Probability Distribution Function of all time date since last measurement restart
Auto Correlation	"Auto Correl1"	Autocorrelation function of the current Main (or Gate) Time result
OBW Summary Trace 1	"OBW Summary Trc1"	Table of Occupied Bandwidth results if OccBW is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.
ACP Summary Trace 1	"ACP Summary Trc1"	Table of Adjacent Channel Power results if ACP is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.
No Data	"No Data"	An empty trace

Key Path	**Trace/Detector**
Mode	VSA

Format

This key provides a menu of Trace Formats from which to choose for the selected trace.

See Trace/Detector, “Format” on page 443 in the section "Common Measurement Functions 2" for more information.

Digital Demod Trace Setup

This key provides a menu that allows you to set Digital Demod parameters for the selected trace.

See Trace/Detector, “Digital Demod Trace Setup” on page 444 in the section "Common Measurement Functions 2" for more information.

Copy to Data Register

This key provides a menu of Data Registers numbered from 1 to 6 into which to copy the selected trace.

See Trace/Detector, “Copy to Data Register” on page 450 in the section "Common Measurement Functions 2" for more information.

Phase/Delay Properties

This key provides a menu that allows you to set Phase and Delay properties for the selected trace.

See Trace/Detector, “Phase/Delay Properties” on page 451 in the section "Common Measurement Functions 2" for more information.

ACP Setup

This key provides a menu that allows you to set ACP setup parameters for the selected trace.

See Trace/Detector, "ACP Setup" on page 453 in the section "Common Measurement Functions 2" for more information.

OBW Setup

This key provides a menu that allows you to set OBW setup parameters for the selected trace.

See Trace/Detector, "OBW Setup (Occupied Bandwidth)" on page 463 in the section "Common Measurement Functions 2" for more information.

Trace Indicator Info

Pressing this key invokes the display of the currently selected trace indicator in the MSG bar at the bottom of the screen.

See Trace/Detector, "Trace Indicator Info" on page 469 in the section "Common Measurement Functions 2" for more information.

Trigger

Triggering is used to determine when a measurement should start taking data. There are several available trigger sources. For each trigger source, there are associated setup parameters. Typically, a trigger event is generated when a signal (or a characteristic of the signal) crosses a defined trigger level (or threshold) on a rising or falling slope. The measurement begins at a specified time delay from the trigger point. The delay may be negative, allowing pretrigger data to be taken. Each trigger source has associated its own trigger level, slope, and delay settings.

See "Trigger" on page 470 in the section "Common Measurement Functions 2" for a description of this function.

View/Display

The View/Display key provides access to a menu that enable you to select display parameters for the current measurement.

View Presets affect the trace layout, trace data assignment, scaling and formatting but do not affect hardware measurement setup.

Remote Command	`:DISPlay:VECTor:VIEW:PRESet SPECtrum|STATistics`
Example	:DISP:VECT:VIEW:PRES SPEC
Key Path	**Front Panel**
Mode	VSA

Display

See “Display” on page 349 in the section "Common Measurement Functions" for a description of this function.

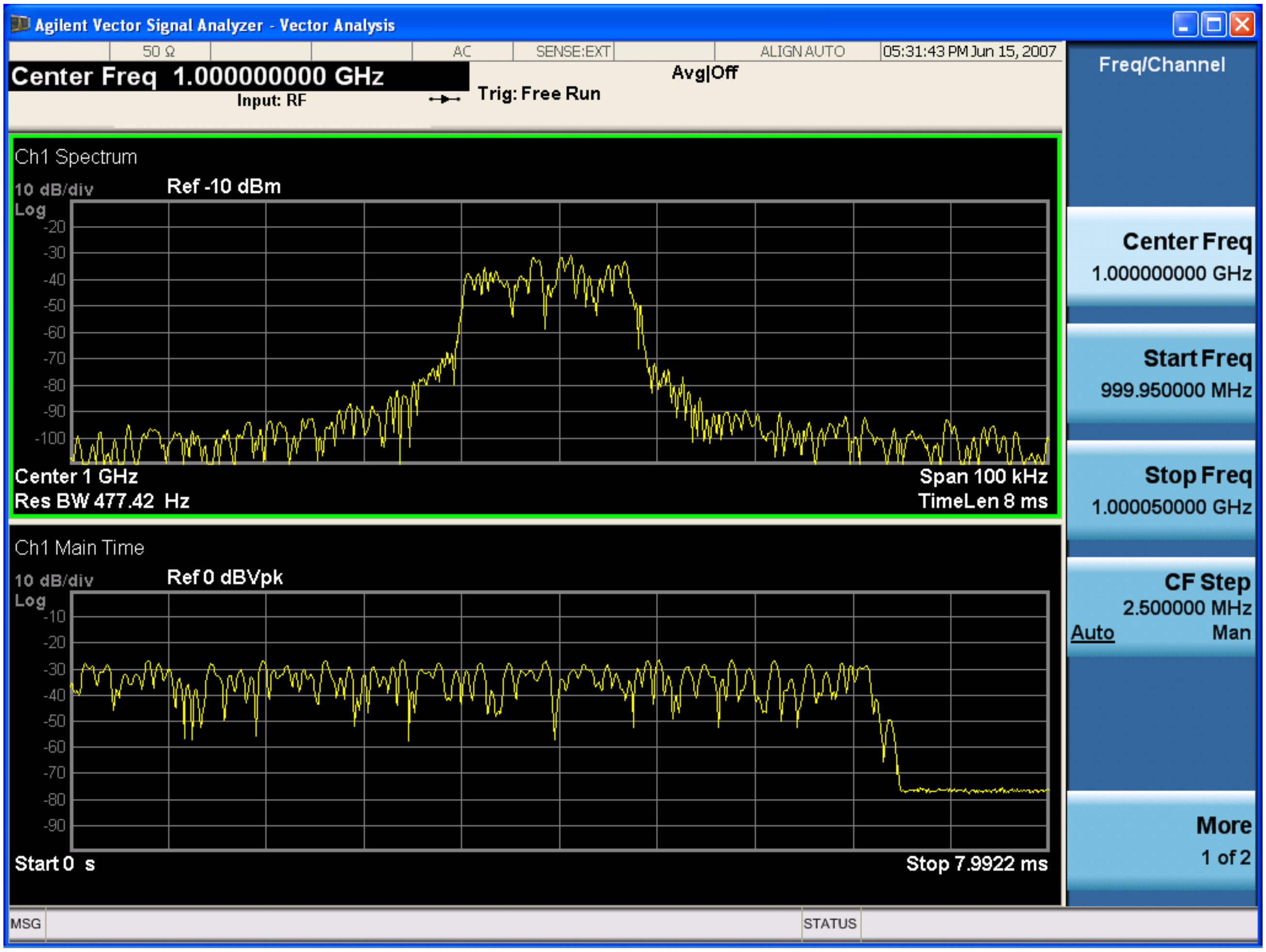
Layout

See “Layout” on page 479 in the section "Common Measurement Functions 2" for a description of this function.

Preset View: Spectrum/Time

This preset uses the Stack 2 layout style (see View/Display, Layout) with Spectrum in trace 1 and Main Time in trace 2

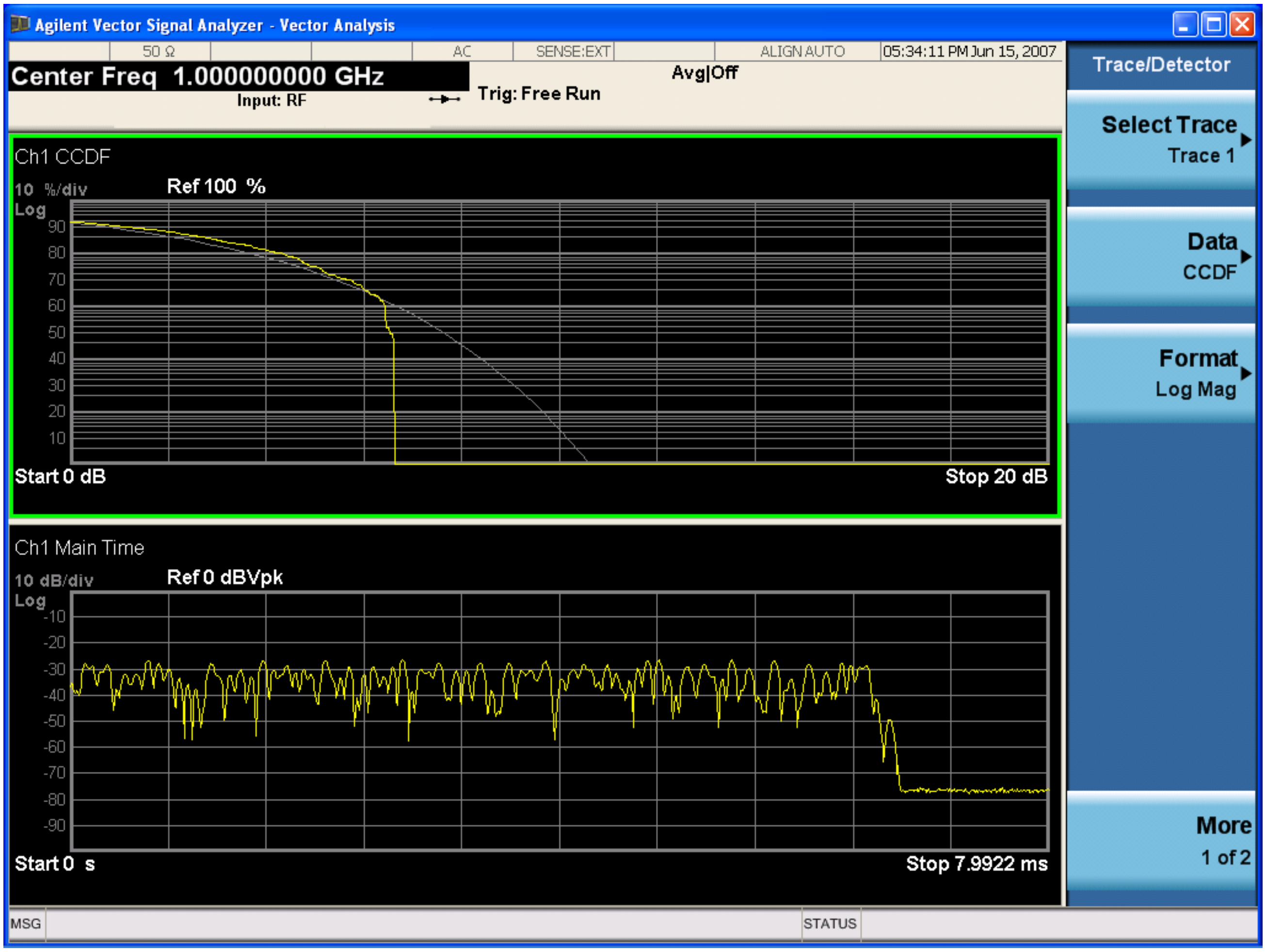
Key Path	**View/Display**
Mode	VSA



Preset View: Statistics

This preset uses the Stack 2 layout style (see View/Display, Layout) with the CCDF in trace 1 and Main Time in trace 2.

Key Path	**View/Display**
Mode	VSA


Agilent Vector Signal Analyzer - Vector Analysis
50 Ω
AC
SENSE:EXT
ALIGN AUTO
05:34:11 PM Jun 15, 2007
Center Freq 1.000000000 GHz
Input: RF
Trig: Free Run
Avg|Off
Trace/Detector
Select Trace
Trace 1
Data
CCDF
Format
Log Mag
More
1 of 2
Ch1 CCDF
10 %/div
Log
Ref 100 %
Start 0 dB
Stop 20 dB
Ch1 Main Time
10 dB/div
Log
Ref 0 dBVpk
Start 0 s
Stop 7.9922 ms
MSG
STATUS

8 Analog Demod

The Analog Demod measurement is accessed from the Meas hardkey. The Analog Demod measurement enhances the capabilities offered by Vector Analysis by adding a demodulation function. AM, FM, and PM signals may be demodulated;, and the output of the demodulator may be further analyzed in the same ways as the input signal. For example, you may look simultaneously at the spectra and time records of the input signal and the demodulated signal. Also available are time gating, autocorrelation, and statistical functions such as CCDF.

This topic contains the following sections:

"Remote Command Results for Analog Demod Measurement" on page 315

"Front Panel Results" on page 315

Remote Command Results for Analog Demod Measurement

The Analog Demod measurement is invoked remotely by the following:

`:CONFigure:ADEMod`

`:CONFigure:ADEMod:NDEFault`

`:INITiate:ADEMod`

Remote results may be obtained using commands from the CALCulate:ADEMod:DATA<n> tree. In addition, the FETCh and READ commands below may be used to obtain ACP and OBW table information when those functions are turned on.

`:FETCh:ADEMod[n]?`

`:READ:ADEMod[n]?`

The MEASure? command is not supported by the Analog Demod measurement.

For more information and remote commands, see "Remote SCPI Commands and Data Queries" on page 482 in the section, "Common Measurement Functions 2".

Also see Trace/Detector, "Data" on page 430 in the section "Common Measurement Functions 2" for more measurement SCPI commands.

Front Panel Results

Analog Demod results may be displayed in any trace, and the traces viewed in a variety of layouts that show 1, 2, 3, or 4 traces at a time. Each trace may be scaled as desired regardless of measurement settings, or auto-scaled to reflect measurement settings. Data may be formatted in a variety of ways. (For example, you may view the log magnitude of complex data, the real or imaginary part, etc.) You may use View Presets to view frequently used results, or to provide a familiar starting point from which you may customize your own view.

Key Path	**Meas**
Mode	VSA

AMPTD Y Scale

See "AMPTD Y Scale (Amplitude)" on page 361 in the section "Common Measurement Functions 2" for a description of this function.

Auto Couple

See “Auto Couple” on page 33 in the section "Common Measurement Functions" for a description of this function.

BW

See "BW (Bandwidth)" on page 368 in the section "Common Measurement Functions 2" for a description of this function.

Cont (Continuous)

See "Cont (Continuous Measurement/Sweep)" on page 35 in the section "Common Measurement Functions 1" for a description of this function.

FREQ Channel

See “FREQ Channel” on page 371 in the section "Common Measurement Functions 2" for a description of this function.

Input/Output

See “Input/Output” on page 43 in the section "Common Measurement Functions " for a description of this function.

Marker

See “Marker” on page 374 in the section "Common Measurement Functions 2" for a description of this function.

Marker Function

See “Marker Function” on page 392 in the section "Common Measurement Functions 1" for a description of this function.

Marker To

See “Marker -> (Marker To)” on page 390 in the section "Common Measurement Functions 1" for a description of this function.

Meas (Measure)

See “Meas” on page 155 in the section "Common Measurement Functions " for a description of this function.

Meas Setup

The common Meas Setup functions are documented in “Meas Setup” on page 400 in the section "Common Measurement Functions 2".

Avg Number

See “Avg Number” on page 400 in the section "Common Measurement Functions 2" for a description of this function.

Average Mode

See “Average Mode” on page 401 in the section "Common Measurement Functions 2" for a description of this function.

Average Setup

See “Average Setup” on page 402 in the section "Common Measurement Functions 2" for a description of this function.

Demod Setup

Allows you to set Demodulation parameters for the current measurement.

For more information see: Measurement Functions, Meas Setup, Demod Setup

Key Path	**Meas Setup**
Mode	VSA

Demod Type

Demod Type lets you select the type of analog demodulation to be applied to your signal. You can select AM, PM, or FM demodulation. In addition, you can enable Auto Carrier Phase and/or Auto Carrier Frequency. Auto carrier controls how the analyzer determines your carrier frequency.

Remote Command	`[:SENSe]:ADEMod:MODulation AM|FM|PM` `[:SENSe]:ADEMod:MODulation?`
Example	ADEM:MOD AM ADEM:MOD?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	AM
State Saved	Saved in instrument state.

Range	AM | FM | PM

AM Units

This allows you to select whether the display units for AM demodulation are in normalized units ("am") or percent ("%").

Remote Command	`[:SENSe]:ADEMod:AM:UNIT AM|PCT` `[:SENSe]:ADEMod:AM:UNIT?`
Restriction and Notes	Greyed out if Demod Type is FM or PM
Example	ADEM:AM:UNIT AM ADEM:AM:UNIT?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	AM
State Saved	Saved in instrument state.
Range	am | %

Auto Carrier Freq

This allows you to turn on or off automatic carrier frequency estimation for FM or PM demodulation. When Auto Carrier Freq is off, the analyzer uses the Center Frequency setting as the carrier. If the actual carrier frequency is different from the center frequency, a ramp is visible in the phase results. Turning on Auto Carrier Freq causes the analyzer to estimate the actual carrier frequency. Propper setting of the carrier frequency is especially important in PM demodulation.

When the VSA is in analog demodulation mode, you can select one of two different types of auto carrier setting. The types of auto carrier setting available depends on the type of demodulation, as shown in the following table.

For this demodulation:	You can use this auto carrier:
AM	None
FM	Auto Carrier Frequency
PM	Auto Carrier Frequency and Auto Carrier Phase

Note that you cannot select auto carrier frequency with AM demodulation. AM demodulation does not require carrier frequency estimation because the AM calculations are based on the carrier envelope. The carrier amplitude estimate is based on data within a single time record and is updated on a record-by-record basis.

Auto Carrier Frequency

Accurate angle demodulation (FM or PM) depends on precisely identifying the carrier frequency. Errors result in phase ramping. The arc tangent of the complex time record is the basis of both PM and FM demodulation. Hence, correcting for the phase ramp is the goal of auto carrier frequency.

Without auto carrier frequency, the analyzer uses its center frequency to determine the carrier frequency of your signal. When auto carrier frequency is selected, the analyzer uses an algorithm to estimate the carrier frequency. If you can lock the analyzer to an external reference which is coherent with your carrier, no carrier frequency estimation is needed, and you do not need to select auto carrier frequency.

When auto carrier frequency is selected, the carrier frequency estimate is calculated independently for each time record, and is used in the demodulation calculation to take out FM offsets, or PM phase ramps due to error between your carrier frequency and the analyzer's LO (center frequency).

Hint

If auto carrier frequency is selected, you can select demod carrier to display the estimated carrier frequency for FM demodulation. Cross channel results show the estimates for both channels. For PM demodulation, you must select both Auto Carrier Frequency and Auto Carrier Phase to display the estimated carrier frequency.

Auto Carrier Frequency and Averaging

The operation of auto carrier frequency is modified if averaging is turned on. For FM measurements, the carrier frequency estimate from the current time record is fed into an exponential average of estimates from prior time records. The resulting, averaged carrier-frequency is used to compensate the current time record for carrier-frequency offsets from the center frequency.

Considerations When Using Auto Carrier Frequency

The following situations can bias the phase ramp estimation:

- Low frequency modulation, such as a periodic signal with fewer than 10 cycles over the time record.
- Phase discontinuities present in digital communication formats.
- Transients, such as carrier turn-on in the middle of the time record.

In cases where biases are unavoidable, auto carrier frequency should be turned off. Where possible, lock the analyzer's external reference to a reference coherent with the carrier to eliminate frequency errors.

Remote Command	`[:SENSe]:ADEMod:CARRier:FREQuency:AUTO OFF|ON|0|1` `[:SENSe]:ADEMod:CARRier:FREQuency:AUTO?`
Restriction and Notes	Greyed out if Demod Type is AM
Example	ADEM:CARR:FREQ:AUTO ON ADEM:CARR:FREQ:AUTO?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

When Auto Carrier Frequency is on (for Demod types FM or PM), the calculated average carrier frequency may be queried for any trace showing a demod result by using the following SCPI command.

Remote Command	:DISPlay:ADEMod:TRACe[1]|2|3|4:CARRier:FREQuency?
Remote Command Notes	This returns the result of the carrier frequency calculation (if Demod Mode is FM or PM and Auto Carrier Freq is on) for the addressed trace (which must be assigned a demod result). Returns NaN otherwise.
Example	DISP:ADEM:TRAC:CARR:FREQ?
Key Path	**SCPI only**
Mode	VSA

Auto Carrier Phase

This allows you to turn on or off automatic carrier phase offset estimation for PM demodulation. Even with Auto Carrier Freq turned on, the PM demodulation may have a fixed or slowly varying phase offset. This function estimates the phase offset and takes it out. A phase offset does not affect FM results, because the offset differentiates to zero.

Remote Command	[:SENSe]:ADEMod:CARRier:PHASe:AUTO OFF|ON|0|1 [:SENSe]:ADEMod:CARRier:PHASe:AUTO?
Restriction and Notes	This is robust enough that it sometimes works even if Auto Carrier Freq is turned off, but it is recommended that you turn on Auto Carrier Freq along with this. Greyed out if Demod Type is AM or FM
Example	ADEM:CARR:PHAS:AUTO ON ADEM:CARR:PHAS:AUTO?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Meas Preset

For more information, see the section under the Preset key in the System Functions section.

Key Path	**Meas Setup**
Mode	VSA

Mode

See “Mode” on page 213in the section "Common Measurement Functions" for a description of this function.

Mode Setup

See “Mode Setup” on page 229 in the section "Common Measurement Functions" for a description of this function.

Single

See “Single (Single Measurement/Sweep)” on page 263 in the section "Common Measurement Functions" for a description of this function.

Trace/Detector

This section details the trace results accessible via the data key and also via SCPI, many of which are available in other measurements as well.

See “Trace/Detector” on page 428 in the section "Common Measurement Functions" for a description of this function.

Select Trace

See “Select Trace” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

Data

This softkey brings up a menu of trace data choices for the selected trace. For more details and SCPI, see Trace/Detector, “Data” on page 430.

The following trace data results are available under the Pre-Demod submenu. They are identical to the results available in the Vector Analysis measurement.

Trace data	**SCPI string form**	**Description**
Spectrum	"Spectrum1"	Averaged result of successive Inst Spectrum results (If RMS or Max averaging is on). Otherwise, FFT of current windowed Main (or Gate) Time
Inst Spectrum	"Inst Spec1"	Instantaneous Spectrum is the FFT of the current windowed Main (or Gate) Time. It is instantaneous in the sense that it isn't rms averaged, but it may included time-averaged data.
Main Time	"Main Time1"	Same as Inst Main Time unless Time averaging is on, in which case it is the averaged result of successive Inst Main Time results. If Time Gating is on, Main Time is the source to which the Gate is applied.
Inst Main Time	"Inst Main Time1"	Instantaneous Main Time is the current corrected, resampled, time record.
Gate Time	"Gate Time1"	Gate Time replaces Main Time as input to results if gating is on.
Raw Main Time	"Raw Main Time1"	Time record as it comes from the hardware, before software resampling or corrections
Power Spectral Density (PSD)	"PSD1"	Power spectrum divided by ResBW
CCDF	"CCDF1"	Complementary Cumulative Distribution Function of all time date since last measurement restart
CDF	"CDF1"	Cumulative Distribution Function of all time date since last measurement restart

Trace data	SCPI string form	Description
PDF	"PDF1"	Probability Distribution Function of all time date since last measurement restart
Auto Correlation	"Auto Correl1"	Autocorrelation function of the current Main (or Gate) Time result

These Demodulation results are available under the Demod submenu. The name of the demod result and the trace title annotation are prefixed with the name of the demodulation type. For example, if you select AM demodulation, then under Trace/Detector, Demod you will be able to select "AM Spectrum" and the trace will be labeled "Ch1 AM Spectrum".

Trace data	SCPI string form	Description
Spectrum	"AnDemod Spectrum1"	Same as calculation for input Spectrum, but using demod time data
Inst Spectrum	"AnDemod Inst Spec1"	Same as calculation for input Inst Spectrum, but using demod time data
Main Time	"AnDemod Main Time1"	Main demodulated time record. Averaging and gating applied in the same manner as input Main Time.
Inst Main Time	"AnDemod Inst Main Time1"	Demodulated Inst Main Time
Gate Time	"AnDemod Gate Time1"	Gated version of Demod Main Time, used as input to all other demod results if gating is on.
Power Spectral Density (PSD)	"AnDemod PSD1"	Power spectrum of demodulated signal divided by ResBW
CCDF	"AnDemod CCDF1"	Complementary Cumulative Distribution Function of all demodulated time date since last measurement restart
CDF	"AnDemod CDF1"	Cumulative Distribution Function of all demodulated time date since last measurement restart
PDF	"AnDemod PDF1"	Probability Distribution Function of all demodulated time date since last measurement restart
Auto Correlation	"AnDemod Auto Correl1"	Autocorrelation function of the current demodulated Main (or Gate) Time result

These data are also available (as they are in all measurements).

OBW Summary Trace 1	"OBW Summary Trc1"	Table of Occupied Bandwidth results if OccBW is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.
ACP Summary Trace 1	"ACP Summary Trc1"	Table of Adjacent Channel Power results if ACP is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.

No Data	"No Data"	An empty trace

Format

This key provides a menu of Trace Formats from which to choose for the selected trace.

See Trace/Detector, “Format” on page 443 in the section "Common Measurement Functions 2" for more information.

Digital Demod Trace Setup

This key provides a menu that allows you to set Digital Demod parameters for the selected trace.

See Trace/Detector, “Digital Demod Trace Setup” on page 444 in the section "Common Measurement Functions 2" for more information.

Copy to Data Register

This key provides a menu of Data Registers numbered from 1 to 6 into which to copy the selected trace.

See Trace/Detector, “Copy to Data Register” on page 450 in the section "Common Measurement Functions 2" for more information.

Phase/Delay Properties

This key provides a menu that allows you to set Phase and Delay properties for the selected trace.

See Trace/Detector, “Phase/Delay Properties” on page 451 in the section "Common Measurement Functions 2" for more information.

ACP Setup

This key provides a menu that allows you to set ACP setup parameters for the selected trace.

See Trace/Detector, “ACP Setup” on page 453 in the section "Common Measurement Functions 2" for more information.

OBW Setup

This key provides a menu that allows you to set OBW setup parameters for the selected trace.

See Trace/Detector, “OBW Setup (Occupied Bandwidth)” on page 463 in the section "Common Measurement Functions 2" for more information.

Trace Indicator Info

Pressing this key invokes the display of the currently selected trace indicator in the MSG bar at the bottom of the screen.

See Trace/Detector, “Trace Indicator Info” on page 469 in the section "Common Measurement Functions 2" for more information.

Trigger

Triggering is used to determine when a measurement should start taking data. There are several available trigger sources. For each trigger source, there are associated setup parameters. Typically, a trigger event is generated when a signal (or a characteristic of the signal) crosses a defined trigger level (or threshold) on a rising or falling slope. The measurement begins at a specified time delay from the trigger point. The delay may be negative, allowing pretrigger data to be taken. Each trigger source has associated its own trigger level, slope, and delay settings.

See "Trigger" on page 470 in the section "Common Measurement Functions 2" for a description of this function.

View/Display (View Presets)

The View/Display key displays a menu that enables you to select display parameters for the current measurement.

View Presets affect the trace layout, trace data assignment, scaling and formatting but do not affect hardware measurement setup.

Remote Command	`:DISPlay:ADEMod:VIEW:PRESet DSPectrum|STATistics`
Example	DISP:ADEM:VIEW:PRES DSP
Key Path	**View/Display**
Mode	VSA

Display

See “Display” on page 349 in the section "Common Measurement Functions" for a description of this function.

Layout

See “Layout” on page 479 in the section "Common Measurement Functions 2" for a description of this function.

Preset View: Demod Spectrum/Time

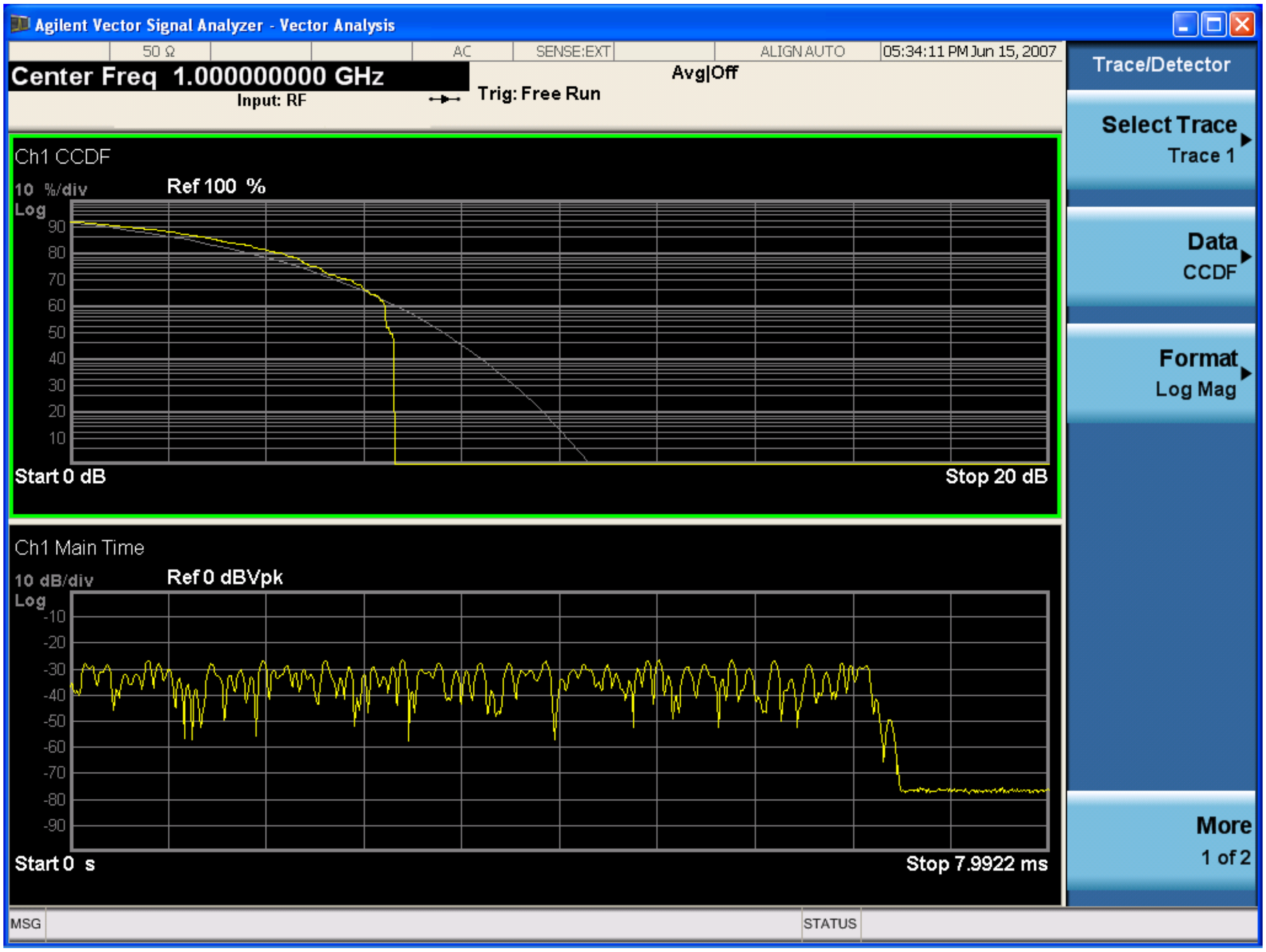
This preset shows a quad layout with the Demod Spectrum in trace 1, Demod Main Time in trace 2, the input Spectrum in trace 3, and the input Main Time in trace 4.

Key Path	**View/Trace**
Mode	VSA

Preset View: Statistics

This preset shows a stacked 2 layout with the CCDF of the input in trace 1 and input Main Time in trace 2.

Key Path	**View/Trace**
Mode	VSA


Agilent Vector Signal Analyzer - Vector Analysis
50 Ω
AC
SENSE:EXT
ALIGN AUTO
05:34:11 PM Jun 15, 2007
Center Freq 1.000000000 GHz
Input: RF
Avg|Off
Trig: Free Run
Ch1 CCDF
10 %/div
Log
Ref 100 %
90
80
70
60
50
40
30
20
10
Start 0 dB
Stop 20 dB
Ch1 Main Time
10 dB/div
Log
Ref 0 dBVpk
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 0 s
Stop 7.9922 ms
MSG
STATUS
Trace/Detector
Select Trace
Trace 1
Data
CCDF
Format
Log Mag
More
1 of 2

9 Digital Demod

The Digital Demod measurement is accessed from the Meas hardkey. The Digital Demod measurement builds upon basic Vector analysis by including flexible demodulation of a wide variety of standard and custom single-carrier modulation formats. You may simultaneously view pre-demod time and spectrum displays, demodulated signal, reconstructed reference signal, recovered symbols and various error traces and summaries.

Measurements are possible on continuous or pulsed (burst) carriers (such as TDMA). In addition, you can specify a sync pattern and an offset to look at selected segments of demodulated data.

The digital demodulator uses your signal to generate an ideal signal (called I/Q reference or FSK reference). You can compare the measured signal to the reference signal to quantify and locate errors in your signal.

Digital demodulation has built-in filters which may be applied to the measured signal as well as to the reference signal. This allows you maximum flexibility in comparing your signal to an ideal signal. Additionally, this allows complete flexibility to probe any analog point in a communication system.

This topic contains the following sections:

"Remote Command Results for Digital Demod Measurement" on page 339

"Front Panel Results" on page 342

Remote Command Results for Digital Demod Measurement

The Digital Demod measurement is invoked remotely by the following:

`:CONFigure:DDEMod`

`:CONFigure:DDEMod:NDEFault`

`:INITiate:DDEMod`

All trace and tabular data results are available using `CALCulate:DDEMod:DATA` commands. These commands also enable you to get names and units of results.

Symbol/Error Table results may also be obtained using the FETCh or READ commands. The Sym/Err table must be assigned to a trace in order to obtain valid results.

`:FETCh:DDEMod[n]?`

`:READ:DDEMod[n]?`

NOTE The MEASure:DDEMod? command is not supported by the Digital Demod measurement.

For more information and remote commands, see "Remote SCPI Commands and Data Queries" on page 482 in the section, "Common Measurement Functions 2".

Also see Trace/Detector, "Data" on page 430 in the section "Common Measurement Functions 2" for more measurement SCPI commands.

Condition	N	Results Returned
All Mod Formats	Not specifie d, or n=1	Error Summary Table Returns 30 comma-separated scalar results, corresponding to the items in the table portion of the Syms/Err trace. Note some values are not available (n/a) for some formats.NaN (9.91 E 37) is returned for results that are not available. 1. EVM rms (% rms) (n/a for FSK) 2. EVM peak (% pk) (n/a for FSK) 3. symbol position of EVM peak (n/a for FSK) 4. offset EVM rms (% rms) (OQPSK only, n/a otherwise) 5. offset EVM peak (% pk) (OQPSK only, n/a otherwise) 6. symbol position of Offset EVM peak (OQPSK only, n/a otherwise) 7. FSK err rms (% rms) (FSK only, n/a otherwise) 8. FSK err peak (% pk) (FSK only, n/a otherwise) 9. symbol position of FSK err peak (FSK only, n/a otherwise) 10. magnitude error rms (% rms). 11. magnitude error peak (% pk) 12. symbol position of magnitude error peak 13. phase error rms (deg) (n/a for FSK) 14. phase error peak (deg pk) (n/a for FSK) 15. symbol position of phase error peak (n/a for FSK) 16. frequency error (Hz) (n/a for FSK) 17. carrier offset (Hz) (FSK only, n/a otherwise) 18. SNR(MER) (dB) (QPSK, QAM, APSK and VSB only, n/a otherwise) 19. FSK deviation (Hz) (FSK only, n/a otherwise) 20. Pilot Level (dB) (8 VSB only, n/a otherwise) 21. time offset (s) (triggered APSK only, n/a otherwise) 22. IQ offset (dB) (n/a for FSK, VSB) 23. amplitude droop (dB/sym) (n/a for QPSK, OQPSK, MSK Type 1, QAM, APSK, VSB and FSK) 24. rho (QPSK and OQPSK only, n/a otherwise) 25. quadrature error (deg) (n/a for BPSK, VSB and FSK) 26. gain imbalance (dB) (n/a for BPSK, VSB and FSK) 27. R2/R1 ratio (dimensionless) (APSK only, n/a otherwise) 28. R3/R1 ratio (dimensionless) (APSK 32 only, n/a otherwise) 29. peak EVM mean (%) (EDGE only, n/a otherwise) 30. 95% EVM (%) (EDGE only, n/a otherwise)

Also available are the standard ACP and OBW tables.

See "Trace/Detector" on page 383.

Front Panel Results

Digital Demod results may be displayed in any trace, and the traces viewed in a variety of layouts that show 1, 2, 3, or 4 traces at a time. Each trace may be scaled as desired regardless of measurement settings, or auto-scaled to reflect measurement settings. Data may be formatted in a variety of ways. (For example, you may view the log magnitude of complex data, the real or imaginary part, etc.) You may use View Presets to view frequently used results, or to provide a familiar starting point from which you may customize your own view.

Key Path	**Front Panel**
Mode	VSA

AMPTD Y Scale

See “AMPTD Y Scale (Amplitude)” on page 361 in the section "Common Measurement Functions 2" for for a description of this function.

Auto Couple

The Auto Couple key forces all Auto/Man functions into Auto. These include the following functions:

- Frequency Step
- X Scale
- Y Axis Unit Preference
- Frequency Points
- Playback Start/Stop

NOTE	This function does not invoke the Auto tune function, nor does it cause any Y autoscaling or Input Auto ranging.

For more information, see "Auto Couple" on page 33 in the section "Common Measurement Functions".

Key Path	**Front Panel**
Mode	VSA

BW

See "BW (Bandwidth)" on page 368 in the section "Common Measurement Functions 2" for a description of this function.

Cont (Continuous)

See “Cont (Continuous Measurement/Sweep)” on page 35 in the section "Common Measurement Functions 1" for a description of this function.

FFT Window

See “FFT Window” on page 371 in the section "Common Measurement Functions 2" for a description of this function.

FREQ Channel

See "FREQ Channel" on page 371 in the section "Common Measurement Functions 2" for a description of this function.

Input/Output

See “Input/Output” on page 43 in the section "Common Measurement Functions " for a description of this function.

Marker

See “Marker” on page 374 in the section "Common Measurement Functions 2" for a description of this function.

Marker Function

See "Marker Function" on page 392 in the section "Common Measurement Functions 2" for a description of this function.

Marker To

See “Marker -> (Marker To)” on page 390 in the section "Common Measurement Functions 1" for a description of this function.

Meas (Measure)

See “Meas” on page 155 in the section "Common Measurement Functions " for a description of this function.

Meas Setup

The common Meas Setup functions are documented in “Meas Setup” on page 400 in the section "Common Measurement Functions 2".

Avg Number

See “Avg Number” on page 400 in the section "Common Measurement Functions 2" for a description of this function.

Average Mode

See “Average Mode” on page 401 in the section "Common Measurement Functions 2" for a description of this function.

Average Setup

See “Average Setup” on page 402 in the section "Common Measurement Functions 2" for a description of this function.

Demod Setup

This key displays a menu that allows you to adjust digital demodulation parameters.

Key Path	**Meas Setup**
Mode	VSA

Modulation Format

This allows you to select the digital communication format that is used by the demodulator. The selection includes:

- QAM formats: QAM 16, QAM 32, QAM 64, QAM 128, QAM 256, QAM 512, and QAM 1024
- PSK formats: BPSK, QPSK, Offset QPSK, /4 DQPSK, DQPSK, 8PSK, /8 D8PSK, and D8PSK
- MSK type 1 and type 2
- FSK formats: FSK 2, FSK 4, FSK 8, and FSK 16
- DVB QAM formats: DVB QAM 16, DVB QAM 32, DVB QAM 64, DVB QAM 128, and DVB QAM 256
- VSB formats: VSB 8 and VSB 16
- APSK (amplitude/phase shift keying) formats: APSK 16, APSK 16 w/DVB, APSK 32, APSK 32 w/DVB
- EDGE

Custom State Definitions

The states that correspond to each constellation position for each format are defined in the following file:

D:\User_My_Documents\Instrument\My Documents\VXA\Data\Constellation\Current.csd

If you want to define custom states, edit this file using Notepad. The file contains instructions and examples to guide you. After saving your changes, you must exit and restart the XSA program for the changes to take effect.

To return the original state definitions, simply delete this file and restart XSA. A new Current.csd file will be created with the original state definitions restored.

Remote Command	`[:SENSe]:DDEMod:MODulation BPSK|QPSK|OQPSK|PI4DQPSK|DQPSK|PSK8|PI8DPSK8|DPSK8|QAM16|QAM32|QAM64|QAM128|QAM256|QAM512|QAM1024|FSK2|FSK4|FSK8|FSK16|MSK1|MSK2|EDGE|APSK16|APSK32|DVBAPSK16|DVBAPSK32|DVBQAM16|DVBQAM32|DVBQAM64|DVBQAM128|DVBQAM256|VSB8|VSB16`
	
	`[:SENSe]:DDEMod:MODulation?`

Example	DDEM:MOD QPSK DDEM:MOD?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	QPSK
State Saved	Saved in instrument state.
Range	BPSK | QPSK | Offset QPSK | /4DQPSK | DQPSK | 8PSK | /8 DPSK8 | D8PSK | QAM 16 | QAM 32 | QAM 64 | QAM 128 | QAM 256 | QAM 512 | QAM 1024 | FSK 2 | FSK 4 | FSK 8 | FSK 16 | MSK Type 1 | MSK Type 2 | EDGE | APSK 16 | APSK 32 | APSK 16 w/DVB | APSK 32 w/DVB | DVB QAM 16 | DVB QAM 32 | DVB QAM 64 | DVB QAM 128 | DVB QAM 256 | VSB 8 | VSB 16

Symbol Rate

The Symbol Rate key allows you to set the symbol rate (symbols per second) for the analyzer's digital demodulator. Set this parameter to match the symbol rate of your system.

In digital modulation, the symbol rate determines the rate (frequency) at which symbols occur. A symbol may consist of one or more bits as determined by the modulation format. For example, in a BPSK system, each symbol represents 1 bit; in a QPSK system, each symbol represents 2 bits.

Symbols are valid only at the timing instant when the receiver interprets the signal. This timing instant is called the detection-decision point.

The analyzer's demodulator uses the symbol rate determine the frequency of your detection-decision points. It is important that you set the symbol rate to match exactly the symbol rate of your system, because the symbol clock frequency is not estimated.

Note that the more complex your modulation format, the more critical it is that the symbol rate be exact.

Specifying an incorrect symbol rate introduces errors into the demodulation process.

The analyzer can accurately measure symbol rates that are less than the maximum span of the analyzer. There may be instances where you want to set the symbol rate beyond what can be measured. The analyzer lets you do this, but accuracy is not specified

If you enter a symbol rate that is slightly different than the symbol rate of your signal, the EVM (error vector magnitude) is typically small at the center of the result length and increases linearly towards the ends of the result length.

The symbol rate determines the maximum frequency span (information bandwidth) that you can measure. For QAM and PSK signals, the symbol rate also determines the minimum frequency span that meets published specifications.

Remote Command	`[:SENSe]:DDEMod:SRATe <frequency>` `[:SENSe]:DDEMod:SRATe?`
Coupling	Span is forced to be < 15.625 * (Symbol rate)
Example	DDEM:SRAT 1 MHZ DDEM:SRAT?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	3840000 HZ
State Saved	Saved in instrument state.
Min	1
Max	9.9E+37

Meas Interval

This key sets the number of symbols that the demodulation will analyze. This and the symbol rate set the overall time record length (in seconds) that is used by the demodulator. It also sets indirectly sets the resolution bandwidth for the various spectrum results. (The ResBW cannot be set independently.)

The resolution bandwidth and Time length are related by the following equation:

Res BW = ENBW / T

where:

ENBW is the normalized effective noise bandwidth of the Window (see the FFT Window topic for more details).

For the pre-demod Spectrum result, T = 1.2*(Meas Interval)/Symbol Rate.

For the all other Spectrum results, T = (Meas Interval)/Symbol Rate.

The resolution bandwidth is annotated below any spectrum trace. To programmatically query the resolution bandwidth, use the following (with the trace number for <n>)

CALC:DDEM:DATA<n>:HEAD? "ResBW"

Remote Command	`[:SENSe]:DDEMod:SWEep:POINts <integer>` `[:SENSe]:DDEMod:SWEep:POINts?`
Example	DDEM:SWE:POIN 137 DDEM:SWE:POIN?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	200
State Saved	Saved in instrument state.
Min	10
Max	4096

Points / Symbol

Allows you to set how many points are displayed per symbol in time displays of demodulated data. The allowed values are 1, 2, 4, 5, 10 and 20.

Points/Symbol do not apply to W-CDMA(3GPP) or cdma2000 demodulation.

Minimum (except OQPSK):	1 point per symbol
Minimum (OQPSK):	2 points per symbol
Maximum:	20 points per symbol
EDGE default (see below):	1 point per symbol

For example, if the value of Points/Symbol is 1, each display point corresponds to a symbol. If the value is 5, the 5th display point corresponds to a symbolin this case, an IQ diagram would show 4 display points between each symbol.

Saving Points/Symbol: When you save a digitally demodulated trace, the Points/Symbol value used to create the trace is saved with the trace. When you recall the trace, the analyzer displays the trace with the Points/Symbol value used to create the tracethe analyzer DOES NOT use the current value of Points/Symbol.

MSK Demodulation: For the MSK demodulation format, changing Points/Symbol affects the error data displayed in the Alphabetical Listing of Error Summary Data. This occurs because the analyzer uses all points to compute Error data results for MSK, whereas the analyzer uses only the points that occur at the symbol times to compute error data results for other demodulation formats.

OQPSK Demodulation: For OQPSK, an even number of Points/Symbol are required due to the offset between I and Q. If you specify an odd value for Points/Symbol, the analyzer chooses the next, lower, even value.

EDGE demodulation: For `EDGE` demodulation format and the Points/Symbol is set to 1 (default), the IQ Meas Time, IQ Magnitude Error, IQ Phase Error and Error Summary Table trace data results are the

ISI (inter-symbol interference) compensated values. That is, when the points/symbol is set to 1 (default), the analyzer removes the effects of ISI (inter-symbol interference), which provides a "clean" IQ Meas Time constellation diagram. For points/symbol greater than one, the trace data results are not compensated for the effects of ISI. For values greater than 1 point/symbol, the symbols in EDGE constellation diagrams may appear randomly placed due to the effects of ISI.

Couple to Gain Imb./Quad Skew: This measurement parameter selection controls the number of points per symbol used to calculate the IQ Gain Imbalance and Quadrature Skew symbol error data results. For further information, see Couple to Gain Imb./Quad Skew, IQ Gain Imbalance, and Quadrature Skew.

Remote Command	`[:SENSe]:DDEMod:PPSYmbol <integer>` `[:SENSe]:DDEMod:PPSYmbol?`
Example	DDEM:PPSY 2 DDEM:PPSY?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Notes	The only supported values are 1, 2, 4, 5, 10 and 20. Numeric entries are rounded to the nearest valid value.
Preset	5
State Saved	Saved in instrument state.
Min	1
Max	20

Gain Imb/Quad Skew Coupling

Controls what measurement data is included in the Quadrature Skew Error and IQ Gain Imbalance error data calculations.

- Off: Calculations use one Point per Symbol.
- On: Calculations use the value shown in the Points per Symbol parameter box.

Remote Command	`:CALCulate:DDEMod:PPSYmbol:COUPle OFF|ON|0|1` `:CALCulate:DDEMod:PPSYmbol:COUPle?`
Coupling	No
Example	CALC:DDEM:PPSY:COUP OFF CALC:DDEM:PPSY:COUP?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Meas Filter

Allows you to select the Meas Filter used by the receiver.

Data filtering is used in digital demodulation to limit bandwidth and reduce intersymbol interference. This analyzer includes several commonly used filter types and has the ability to apply user-defined filters. All filters are computed to 20 symbols in length. If the filter alpha is < 0.2, the analyzer uses 40 symbols to compute filter length (for most formats).

The shape and width of a filter is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). The alpha or BT indicates the filter roll-off (or excess bandwidth) of the selected filter which occurs due to the practical inability of filter technology to build a perfectly square (brick-wall) filter which would have an alpha of 0 (no excess bandwidth). For example, a typical filter with an alpha of 0.3 has a bandwidth 30% greater than the theoretical minimum.

The analyzer's digital demodulator produces two signals: a measured and a reference signal. These signals are called I/Q Measured and I/Q Reference or, for FSK measurements, FSK Measured and FSK Reference.

You can select different filters for the measured and reference signals, as shown in the following, generic block diagram.

Note that for FSK signals, filtering is baseband and occurs after the FM demodulator.

The measured signal is the signal that results after demodulating your waveform. The reference signal is the signal that would result after demodulating your signal if your signal were ideal (contained no errors).

Notice that there are separate filters for the measured and reference signals. You MUST select the correct filter for both signals.

Filtering for various communication systems may occur either at the transmitter or the receiver; or the filtering may be distributed between the transmitter and the receiver. This is an important concept which affects your filter selection for the measured and reference signals. The analyzer's measured filter represents filtering in the system's receiver while the reference filter represents filtering in the entire system. Both filters share the same alpha/BT. The following table shows some examples of filter selection:

If the transmitter filter is:	The measure filter should be:	The reference filter should be:
root raised cosine	root raised cosine	raised cosine
Raised cosine	none	raised cosine
Gaussian	none	Gaussian
any type	user defined	any type

You can modify the shape and width of Gaussian and Nyquist (cosine) filters. The shape and width is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). All filters are computed to 20 symbols in length. If the filter alpha is < 0.2, the analyzer uses 40 symbols to compute filter length (for most formats).

Remote Command	[:SENSe]:DDEMod:FILTer:MEASurement NONE|RRCosine|GAUSsian|EDGE|IS95EQ|RECTangle|LPASs|USER [:SENSe]:DDEMod:FILTer:MEASurement?
Example	DDEM:FILT:MEAS RRC DDEM:FILT:MEAS?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Notes	USER defined requires you to specify a register (see Meas User Defined).
Preset	RRC
State Saved	Saved in instrument state.
Range	No Filter | Root Raised Cosine | Gaussian | EDGE | CDMA (IS–95A Base EQ) | Rectangular | Low Pass | User Defined
Readback Text	No Filter | RRC | Gaussian | EDGE | CDMA (EQ) | Rectangular | Low Pass | User Defined

Meas User Defined

Pressing this key sets the Meas Filter to User Defined. Pressing it a second time allows you to select a data register which contains data that defines the filter.

The analyzer lets you use a filter of your design for the I/Q measured filter or the I/Q reference filter. Typical applications for user-defined filters include:

- Custom filters other than those provided. In this case both measured and reference filters are user defined.
- Modified filters that are based on the raised cosine filter but add channel equalization. In this case, the measure filter is a user-defined filter and the reference filter is standard.

To define a filter, create a trace file containing the time-domain impulse response of the filter. (The easiest way to start is to export a time domain trace into a file in text or csv format and modify it. See Utility (System Functions), Save, Export Trace Data .) Then recall the trace file into the desired register. (See Utility (System Functions), Recall, Import Trace Data.) The data must satisfy these criteria:

- Only be real data, not complex
- Only be time-domain data. If the data domain type cannot be determined from the trace file (unknown domain), the analyzer will default to time-domain data. If any other domain is used, for example the frequency-domain, the analyzer will reject the user-defined trace file and use a root raised cosine filter as the Measurement filter and a raised cosine filter as the Reference filter.
- Contain > 0 and <= 20 symbols (401 samples) in overall length. However, if the filter alpha is < 0.2, the trace length must be <= 40 symbols (801 samples) in overall length.
- Contain 20 samples-per-symbol. For example, 401 samples = 20 symbols at 20 points-per-symbol.

- Use an odd number of points so that the center of the impulse is positioned on a symbol, this would be the 201st point in a 401 point trace. The middle sample is assumed to be at t = 0.

If the trace file does not satisfy all of previously mentioned criterion, the analyzer rejects the user-defined trace file and defaults to using the root raised cosine filter as the Measurement filter and the raised cosine filter as the Reference filter.

Accuracy of user-defined filters is undefined. In addition, the value of Alpha/BT has no effect on user-defined filters.

Remote Command	`[:SENSe]:DDEMod:FILTer:MEASurement:REGister D1|D2|D3|D4|D5|D6` `[:SENSe]:DDEMod:FILTer:MEASurement:REGister?`
Coupling	Filter Alpha influences length constraint (see above) but has no other effect.
Example	DDEM:FILT:MEAS:REG D1 DDEM:FILT:MEAS:REG?
Key Path	**Meas Setup, Demod Setup, Meas Filter**
Mode	VSA
Notes	Individual Data register selections are greyed out if they do not contain appropriate data for use as filter coefficients.
Preset	D1
State Saved	Saved in instrument state.
Range	Data 1 | Data 2 | Data 3 | Data 4 | Data 5 | Data 6

Ref Filter

Pressing this key selects the Ref Filter that represents the cascaded transmit and receive filter.

This analyzer includes several commonly used filter types and has the ability to apply user-defined filters. All filters are computed to 20 symbols in length. If the filter alpha is < 0.2, the analyzer uses 40 symbols to compute filter length (for most formats).

The shape and width of a filter is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). The alpha or BT indicates the filter roll-off (or excess bandwidth) of the selected filter which occurs due to the practical inability of filter technology to build a perfectly square (brick-wall) filter which would have an alpha of 0 (no excess bandwidth). For example, a typical filter with an alpha of 0.3 has a bandwidth 30% greater than the theoretical minimum.

The analyzer's digital demodulator produces two signals: a measured and a reference signal. These signals are called I/Q Measured and I/Q Reference or, for FSK measurements, FSK Measured and FSK Reference. The following table shows some examples of filter selection:

If the transmitter filter is:	The measure filter should be:	The reference filter should be:
root raised cosine	root raised cosine	raised cosine

If the transmitter filter is:	The measure filter should be:	The reference filter should be:
raised cosine	none	raised cosine
Gaussian	none	Gaussian
any type	user defined	any type

You can modify the shape and width of Gaussian and Nyquist (cosine) filters. The shape and width is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). All filters are computed to 20 symbols in length. If the filter alpha is < 0.2, the analyzer uses 40 symbols to compute filter length (for most formats).

Matched filtering of a demodulated signal is not available with the MSK demodulators. The measured filter is normally off. A user defined filter can be selected. Its primary use is for additional band-limiting and channel equalization.

Remote Command	`[:SENSe]:DDEMod:FILTer:REFerence RCOSine|RRCosine|GAUSsian|EDGE|IS95BB|RECTangle|HSINe|USER` `[:SENSe]:DDEMod:FILTer:REFerence?`
Example	DDEM:FILT:REF RCOS DDEM:FILT:REF?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Notes	Individual Data register selections are greyed out if they do not contain appropriate data for use as filter coefficients. USER defined requires you to specify a register (see Ref User Defined).
Preset	RCOS
State Saved	Saved in instrument state.
Range	Raised Cosine | Root Raised Cosine | Gaussian | EDGE | CDMA (IS–95 Base) | Rectangular | Half Sine | User Defined
Readback Text	Raised Cosine | RRC | Gaussian | EDGE | CDMA (Base) | Rectangular | Half Sine | User Defined

Ref User Defined

Pressing this key causes the Ref Filter to become User Defined. Pressing it a second time displays a menu that allows you to select the data register which containing the data that defines the filter.

To define a filter, create a trace file containing the impulse response of the filter. (The easiest way to start is to export a time domain trace into a file in text or CSV format and modify it Then recall the file into the desired register. The data must satisfy these criteria:

- Only be real data, not complex

- Only be time-domain data. If the data domain type cannot be determined from the trace file (unknown domain), the analyzer will default to time-domain data. If any other domain is used, for example the frequency-domain, the analyzer will reject the user-defined trace file and use a root raised cosine filter as the Measurement filter and a raised cosine filter as the Reference filter.
- Contain > 0 and <= 20 symbols (401 samples) in overall length. However, if the filter alpha is < 0.2, the trace length must be <= 40 symbols (801 samples) in overall length.
- Contain 20 samples-per-symbol. For example, 401 samples = 20 symbols at 20 points-per-symbol.
- Use an odd number of points so that the center of the impulse is positioned on a symbol, this would be the 201st point in a 401 point trace. The middle sample is assumed to be at t = 0.

Remote Command	`[:SENSe]:DDEMod:FILTer:REFerence:REGister D1|D2|D3|D4|D5|D6` `[:SENSe]:DDEMod:FILTer:REFerence:REGister?`
Coupling	Filter Alpha influences length constraint (see above) but has no other effect.
Example	DDEM:FILT:REF:REG D1 DDEM:FILT:REF:REG?
Key Path	**Meas Setup, Demod Setup, Ref Filter**
Mode	VSA
Preset	D1
State Saved	Saved in instrument state.
Range	Data 1 | Data 2 | Data 3 | Data 4 | Data 5 | Data 6

Alpha / BT

Determines the filter characteristics of the Raised cosine, Root-raised cosine and Gaussian filters used by the analyzer's digital demodulator. These characteristics apply to both the Meas and Ref filters.

Allowable values,

Raised cosine, root-raised cosine filters: .05 to 1

Gaussian filters: .05 to 100

Remote Command	`[:SENSe]:DDEMod:ALPHa <real>` `[:SENSe]:DDEMod:ALPHa?`
Coupling	Alpha also determines length criteria for user defined meas and ref filters
Example	DDEM:ALPH 0.22 DDEM:ALPH?
Key Path	**Meas Setup, Demod Setup**
Mode	VSA

Preset	0.22
State Saved	Saved in instrument state.
Min	0.05
Max	100

Burst/Sync Search

This key displays a menu that allows you to select Burst and Sync searches, and to select search parameters for the current measurement..

Key Path	**Meas Setup, Demod Setup**
Mode	VSA

Search Length

This defines the time length over which the analyzer will search for a burst and/or sync word. . You can specify search length in number of symbols or units of time.

Remote Command	`[:SENSe]:DDEMod:SYNC:SLENgth <time>` `[:SENSe]:DDEMod:SYNC:SLENgth?`
Coupling	Minimum: Meas Interval / Symbol Rate Maximum: Depends on span
Example	DDEM:SYNC:SLEN 200 US DDEM:SYNC:SLEN?
Key Path	**Meas Setup, Demod Setup, Burst/Sync Search**
Mode	VSA
Preset	666.666667E–6
State Saved	Saved in instrument state.
Min	0
Max	9.9E+37

Burst Search

This key turns on or off burst search

Remote Command	`[:SENSe]:DDEMod:SYNC:BURSt:STATe OFF|ON|0|1` `[:SENSe]:DDEMod:SYNC:BURSt:STATe?`
Example	DDEM:SYNC:BURS:STAT OFF DDEM:SYNC:BURS:STAT?

Key Path	**Meas Setup, Demod Setup, Burst/Sync Search**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Sync Search

This key turns on or off Sync Word search. Sync search lets you use a synchronization pattern to isolate a segment of your signal for display and analysis. The analyzer searches through demodulated data to find your sync pattern, and then uses the Result Length to determine how much data to display and the Search Offset to display data relative to the sync pattern.

NOTE The sync pattern must be a multiple of the number of bits-per-symbol. For example, if the number of bits-per-symbol is 4 (as with 16 QAM), then the number of bits in the sync pattern must be a multiple of four. Sync search lets you specify any number of bits for the sync pattern; however, bits that are not a multiple of the bits-per-symbol are truncated.

Remote Command	`[:SENSe]:DDEMod:SYNC:SWORd:STATe OFF|ON|0|1` `[:SENSe]:DDEMod:SYNC:SWORd:STATe?`
Example	DDEM:SYNC:SWOR:STAT OFF DDEM:SYNC:SWOR:STAT?
Key Path	**Meas Setup, Demod Setup, Burst/Sync Search**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Sync Pattern

This allows you to define a bit pattern for the sync word search. The maximum length of the pattern is 32 symbols. When you press this key, an editor dialogappears that allows you to define the pattern in binary or hexadecimal.

The analyzer can only search for search patterns that are a multiple of the number of bits-per-symbol. The analyzer assembles the bits in the search pattern into an integer number of symbols, ignoring any trailing bits that cannot complete a full symbol.

For example, if the number of bits-per-symbol is 4 (as with 16 QAM), and your search pattern contains 18 bits, the analyzer only uses the first 16 bits during sync search and ignores the last two bits.

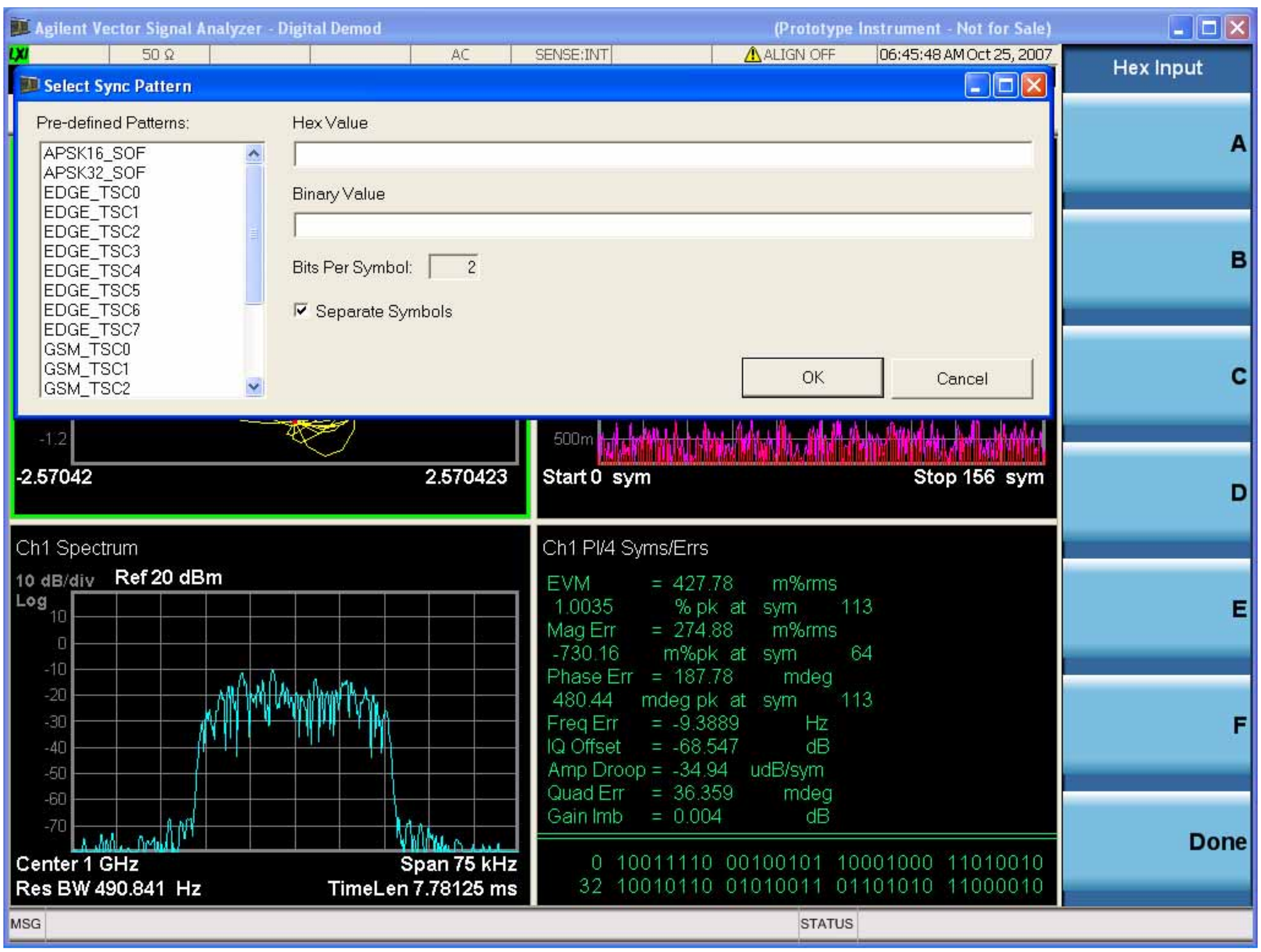
Although the underlying sync pattern is binary, the editor allows you to enter bit patterns in either binary or hexadecimal.

Hexadecimal entries are in symbol table hex format. In this format, each symbol is represented by 1 to 3 hex digits. The least significant bits are used make up the symbol and any extra bits are ignored. Thus, for 6 bits per symbol, the binary value of 101101 is encoded in hex as 2D. If you entered AD as the symbol value, it would be converted to the same binary value as 2D would, because the upper 2 bits would be ignored. 3-bit-wide symbols are represented by 1 hex digit with the most significant bit ignored.

Predefined sync patterns are available for GSM/EDGE and APSK. If you choose one of these formats from the list, it populates the sync pattern hex and binary text boxes with their predefined value.

When Separate Symbols is turned on , spaces appear between symbols in the binary representation.

You can navigate around the dialog without needing a mouse. Pressing tab right and tab left move you from one control to the next. Arrow keys and the knob can be used to navigate within a list or editing box. The space key will toggle the Separate Symbols check box on and off. Softkeys and the numeric entry keys are used to enter patterns. Press Select or Done to complete the entry. Cancel or Return returns exits the dialog without changing the pattern.



Remote Command	[:SENSe]:DDEMod:SYNC:SWORd:PATTern <string>
	[:SENSe]:DDEMod:SYNC:SWORd:PATTern?

Example	DDEM:SYNC:SWOR:PATT '1011010' DDEM:SYNC:SWOR:PATT?
Key Path	**Meas Setup, Demod Setup, Burst/Sync Search**
Mode	VSA
Notes	<string> must be a string of 1s and 0s only. The maximum string length is 320 bits.
Preset	=""
State Saved	Saved in instrument state.

Sync Offset

This key specifies the time (in symbols) between the start of the measurement data and the start of the sync word. If positive, the sync word starts after the start of the measurement data. If negative, the sync word starts before the start of the measurement data.

The minimum and maximum offsets you can enter depend on these parameters:

Search Length

Result Length

Sync Pattern

Basically, you can enter any offset such that the result length falls within the search length. Increasing any of these parameters affects the maximum positive or negative offset that you can enter as follows:

Increasing search length increases the maximum positive or negative offset that you can enter.

Increasing result length decreases the maximum negative offset that you can enter but has no effect on the maximum positive offset.

Increasing the length of the sync pattern decreases the maximum positive offset that you can enter but has no effect on the maximum negative offset.

Remote Command	`[:SENSe]:DDEMod:SYNC:SWORd:OFFSet <integer>` `[:SENSe]:DDEMod:SYNC:SWORd:OFFSet?`
Coupling	Max and min constrained by Search Length, Sync Pattern length
Example	DDEM:SYNC:SWOR:OFFS –3 DDEM:SYNC:SWOR:OFFS?
Key Path	**Meas Setup, Demod Setup, Burst/Sync Search**
Mode	VSA
Preset	0
State Saved	Saved in instrument state.
Min	see coupling

Max	see coupling

Advanced Dig Demod

This key displays a menu that allows you to select advanced demodulation parameters for the current measurement. These settings are for advanced users and do not normally require adjustment for most common measurements.

Key Path	**Meas Setup, Demod Setup**
Mode	VSA

Clock Adjust

This key allows you to adjust symbol clock timing in fractions of a symbol. The adjustment is relative to the symbol clock time that is computed by the demodulation algorithm. Some digital communications systems contain nonlinearities that can bias the digital demodulator's estimation of the symbol clock position. You can use clock adjust to compensate for this offset and obtain a lower EVM (Error Vector Magnitude).

Specifying a clock adjust only affects the I/Q measured trace. It does not affect the I/Q reference trace.

Use the eye diagram with an eye length of one (1) to observe the accuracy of the symbol clock timing. You may also want to monitor the EVM (Error Vector Magnitude) in the symbol table summary while adjusting clock adjust to obtain the optimum symbol timing.

Clock adjust is reset to 0.0 on power-up or when you select Preset.

Remote Command	`[:SENSe]:DDEMod:CADJust <real>` `[:SENSe]:DDEMod:CADJust?`
Example	DDEM:CADJ 0.14 DDEM:CADJ?
Key Path	**Meas Setup, Advanced Dig Demod**
Mode	VSA
Notes	The parameter is interpreted as a fraction of a sample
Preset	0
State Saved	Saved in instrument state.
Min	–0.5
Max	0.5

IQ Rotation

This rotates the Meas/Ref Time data and corresponding ideal state positions by a user defined amount ranging from –360 degrees to 360 degrees. The Rotation parameter affects the IQ Gain Imbalance and

Quadrature Skew error data results.

Remote Command	`:CALCulate:DDEMod:IQRotation <real>` `:CALCulate:DDEMod:IQRotation?`
Example	CALC:DDEM:IQR 45 CALC:DDEM:IQR?
Key Path	**Meas Setup, Advanced Dig Demod**
Mode	VSA
Notes	The numeric parameter is interpreted as degrees.
Preset	0
State Saved	Saved in instrument state.
Min	–360
Max	360

IQ Normalize

Turns IQ Normalize on and off. When IQ Normalize is on, the Meas Time and Ref Time data is normalized so the extreme points have a value of 1. For quadrature modulation types, the outermost points of the constellation are normalized to 1. (Note, for non-square QAM constellation, the points that appear at the corners of the containing square are normalized to 1.) For FSK constellations, the deviation is normalized to 1.

When IQ Normalize is turned off, the actual data values based on the input signal level are plotted on the constellation.

When normalization is ON, the analyzer normalizes or scales the demodulated trace data results to a nominal value of 1. Normalization is performed on these traces:

IQ measured time for Digital, WLAN-OFDM, WLAN-DSSS/CCK/PBSS, WCDMA, cdma2000, TD-SCDMA and 1xEV-DO demodulation.

IQ reference time for Digital, WLAN-OFDM, WLAN-DSSS/CCK/PBSS, WCDMA, cdma2000, TD-SCDMA and 1xEV-DO demodulation.

Error vector time

FSK measured time (FSK measurements)

FSK measured reference (FSK measurements)

Carrier error magnitude (FSK measurements)

FSK error (FSK measurements)

CDP and CDE measurements for W-CDMA, cdma2000 1xEV-DO and TD-SCDMA demodulation)

Remote Command	`:CALCulate:DDEMod:NORMalize OFF|ON|0|1` `:CALCulate:DDEMod:NORMalize:?`

Example	CALC:DDEM:NORM ON CALC:DDEM:NORM?
Key Path	**Meas Setup, Advanced Dig Demod**
Mode	VSA
Preset	ON
State Saved	Saved in instrument state.

APSK R2 / R1

This allows you to specify the expected ratio between the two inner rings for APSK modulation formats.

APSK R2 / R1 determines the Ring 2 to Ring 1 ratio for APSK format measurements.

The ring ratio is the ratio of the magnitude of symbol states on a ring (R2) to the magnitude of symbol states on the inner ring (R1). R2 / R1 is a valid parameter for both 16 APSK and 32 APSK format measurements.

Remote Command	`[:SENSe]:DDEMod:APSK:R2Ratio <real>` `[:SENSe]:DDEMod:APSK:R2Ratio?`
Example	DDEM:APSK:R2R 3 DDEM:APSK:R2R?
Key Path	**Meas Setup, Advanced Dig Demod**
Mode	VSA
Notes	Affects the position of the ideal state indicators on constellation diagrams
Preset	2.84
State Saved	Saved in instrument state.
Min	1.25
Max	8

APSK R3 / R1

This allows you to specify the expected ratio between the outer and inner rings for APSK32 modulation formats.

APSK R3 / R1 determines the Ring 3 to Ring 1 ratio for APSK format measurements.

The ring ratio is the ratio of the magnitude of symbol states on a ring (R3) to the magnitude of symbol states on the inner ring (R1). R3 / R1 is a valid parameter only for 32 APSK format measurements.

Remote Command	`[:SENSe]:DDEMod:APSK:R3Ratio <real>` `[:SENSe]:DDEMod:APSK:R3Ratio?`

Example	DDEM:APSK:R3R 5 DDEM:APSK:R3R?
Key Path	**Meas Setup, Advanced Dig Demod**
Mode	VSA
Notes	Affects the position of the ideal state indicators on constellation diagrams
Preset	5.27
State Saved	Saved in instrument state.
Min	1.5625
Max	10

Low SNR Enhancement

Enhances the ability of the demodulator to lock on to signals with low SNR. This process reduces the frequency lock range and enables additional filtering. This filtering allows the demodulator to lock in the presence of more. To compensate for the smaller frequency lock range, the frequency estimate is tracked from measurement to measurement. An exponential average is used and the output of this average becomes the starting point for the next frequency estimate for the next measurement.

This enhancement is only available for the following modulation formats:

- All QAM and DVB QAM formats
- BPSK, QPSK, and 8PSK
- All APSK (amplitude/phase shift keying) and DVB APSK formats
- EDGE

Remote Command	`[:SENSe]:DDEMod:LSNR OFF|ON|0|1` `[:SENSe]:DDEMod:LSNR?`
Example	DDEM:LSNR OFF DDEM:LSNR?
Key Path	**Meas Setup, Advanced Dig Demod**
Mode	VSA
Notes	Softkey is greyed out for formats not supported.
Preset	OFF
State Saved	Saved in instrument state.

Adaptive Equalizer Setup

This key displays a menu that allows you to select Adaptive Equalizer parameters for the current measurement. Adaptive equalization removes linear errors from modulated signals by dynamically creating and applying a FIR (feed-forward) compensating filter. Linear errors can come from filters in a transmitter or receiver's IF, or from the presence of multiple paths in the transmission path, such as reflections in a cable system. These types of problems appear as group-delay distortion, frequency-response errors (tilt, ripple), and reflections or multipath distortion.

Equalization allows measurement of some impaired channels and can be used to isolate linear from nonlinear error mechanisms. Equalization does not require symbol lock or prior knowledge of the signal (such as a training sequence) and is compatible with recorded data.

By default, the equalization filter has a unit impulse response which yields a flat frequency response (only one tap in the filter has a non-zero value and data simply passes through the filter). The position of the unit impulse is a function of the filter length and is positioned to provide the most optimum efficiency for most situations. The position cannot be adjusted.

The equalization filter has a unit impulse response when you:

first run the application

reset the equalizer filter

change points/symbol.

change the measured or reference filter

change the symbol rate

change the clock delay adjustment

change the equalizer filter length

preset the application

Aside from the above conditions, the application uses the last computed coefficients when you enable equalization. For example, if you used equalization in a previous measurement, the application uses the coefficients from the previous measurement unless you select reset the equalization filter or change [points/symbol]. Therefore, it is good practice to reset the equalization filter to initialize the filter coefficients before you start a measurement.

Key Path	**Meas Setup**
Mode	VSA

Filter

Turns adaptive equalization filter on or off. Adaptive equalization uses the measured signal to determine the coefficients of the equalization filter.

When equalization is, the equalization filter has a unit impulse response. The length of the filter determines the position of the unit impulse response in the filter. The impulse is located in the center of the filter for short filter lengths. As the filter length increases, the impulse moves, proportionally, towards the start of the filter to handle channels with large delay-spread.

If Adaptive is set to run, the analyzer uses the results of the current measurement to update the filter coefficients for the next measurement. The analyzer chooses coefficients that produce a modulation quality metric that is less impacted by the presence of linear distortion.

If Adaptive is set to hold, the analyzer does not update the filter coefficients. Instead, the analyzer uses the last updated coefficients before selecting hold.

You can select run or hold at any time to continue or stop updating filter coefficients.

Note that the analyzer does not redefine the equalization filter to have a unit impulse response when you select run or when you turn the equalization filter off and then on instead, the analyzer uses the last updated filter coefficients.

Equalization is applied to time-domain data. To see where equalization is applied, see the block diagram for [Digital Demodulation] in this block diagram, equalization is applied in the time-domain corrections block.

For best results, make sure you select a frequency span that contains all energy of your signal. If significant energy from your signal falls outside of the displayed frequency span, equalization will not work on your signal.

You can define the length of the equalization filter (in symbols) and set the convergence (convergence determines the size of the steps used to reshape the equalization filter). For additional details about these parameters, see online help for convergence and filter length.

You can use equalization with pulse search and sync search. Note, however, that the adaptive equalizer does not update the filter coefficients when a "Pulse Not Found" condition exists. In other words, if pulse search is on and the measurement results in a "pulse not found" message, the results of that measurement will not affect the equalization filter coefficients. The same is true if sync search is on and the measurement results in a "SYNC NOT FOUND" message.

The following parameters affect measurement speed when using adaptive equalization:

result length

filter length (for the equalization filter)

points/symbol

Remote Command	`[:SENSe]:DDEMod:EQUalization:STATe OFF|ON|0|1` `[:SENSe]:DDEMod:EQUalization:STATe?`
Example	DDEM:EQU:STAT ON DDEM:EQU:STAT?
Key Path	**Meas Setup, Adaptive Equalizer Setup**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Filter Length

Sets the length (in symbols) of the for the analyzer's equalization filter.

In general, the best filter length is the smallest that meets your measurement requirements. For measurements at the transmitter, the filter length may only need to be a few symbols in length. Longer filter lengths may be needed to measure multi-path environments.

The filter length also determines the placement of the impulse response in the equalization filter. For longer filter lengths, the analyzer puts the initial, unit impulse response closer to the beginning of the time record to accommodate multi-path measurements, as follows:

Filter Length	**Unit Impulse Response Position**
(symbol)	**(symbol)**
3 to 31	(length – 1)/2
31 to 75	15
75 to 99	(length)/5

For example, if the filter length is 11, the unit impulse response is positioned at symbol 5. If the filter length is 35, the unit impulse response is positioned at symbol 15.

Remote Command	`[:SENSe]:DDEMod:EQUalization:FLENgth <integer>` `[:SENSe]:DDEMod:EQUalization:FLENgth?`
Example	DDEM:EQU:FLEN 31 DDEM:EQU:FLEN?
Key Path	**Meas Setup, Adaptive Equalizer Setup**
Mode	VSA
Notes	Must be an odd number. If an even number is entered, it is rounded up to the next odd.
Preset	21
State Saved	Saved in instrument state.
Min	3
Max	99

Convergence

Sets the adaptive filter convergence factor higher to converge faster. Note that too high a value can cause the filter to not converge. Set convergence factor smaller for better accuracy.

Remote Command	`[:SENSe]:DDEMod:EQUalization:CONVergence <real>` `[:SENSe]:DDEMod:EQUalization:CONVergence?`
Example	DDEM:EQU:CONV 2 DDEM:EQU:CONV?
Key Path	**Meas Setup, Adaptive Equalizer Setup**
Mode	VSA

Preset	1
State Saved	Saved in instrument state.
Min	0
Max	10000000

Hold

Turns the filter coefficient updates on or off. Normally the adaptation algorithm updates the filter coefficients after each scan. When Hold is on, the coefficients of the equalization filter are frozen, that is., the adaptive filter becomes fixed. When you turn Hold off again, the coefficients are again allowed to adapt, starting from where they currently are.

Remote Command	`[:SENSe]:DDEMod:EQUalization:HOLD OFF|ON|0|1` `[:SENSe]:DDEMod:EQUalization:HOLD?`
Example	DDEM:EQU:HOLD ON DDEM:EQU:HOLD?
Key Path	**Meas Setup, Adaptive Equalizer Setup**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Reset Filter Coefficients

This function resets the adaptive filter coefficients to 1.

Remote Command	`[:SENSe]:DDEMod:EQUalization:RESet`
Example	DDEM:EQU:RES
Key Path	**Meas Setup, Adaptive Equalizer Setup**
Mode	VSA

Preset to Standard

This key allows you to preset Digital Demod Setup parameters and Span to measure a wide variety of standard digital communications formats. Preset to Standard does not constrain you from afterward making any possible adjustment to measurement parameters. The following standard presets are available:

- Cellular: IS–95 Base and Mobile, GSM, EDGE, CDPD, NADC, PDC, PHP, 3GPP (W-CDMA)
- Wireless Networking: 802.11b, HIPERLAN/1 (HBR and LBR), Bluetooth, ZigBee 868, 915, and 2450
- Digital Video: DTV8, DTV16, DVB16, DVB32, DVB64, DVB128, DVB256, DVB 16APSK with

code rates 2/3 to 9/10, DVB 32 APSK with code rates 3/4 to 9/10.

- Other: APCO 25, DECT, TETRA, VDL Mode 3

Remote Command	[:SENSe]:DDEMod:STANdard:PRESet CDMABTS|CDMAMS|CDPD|EDGE|GSM|NADC|PDC|PHS|WCDMA|BLUETOOTH|HIPERLANHBR|HIPERLANLBR|WLAN11B|ZIGBEE2450|ZIGBEE868|ZIGBEE915|DTV8|DTV16|DVB16|DVB32|DVB64|DVB128|DVB256|DVB16APSK23|DVB16APSK34|DVB16APSK45|DVB16APSK56|DVB16APSK89|DVB16APSK910|DVB32APSK34|DVB32APSK45|DVB32APSK56|DVB32APSK89|DVB32APSK910|APCO|DECT|TETRA|VDL3
Example	DDEM:STAN:PRES CDMABTS
Key Path	**Meas Setup**
Mode	VSA

Meas Preset

This key performs the same function as Meas Setup, Preset to Standard, W-CDMA. For more information, see the section under the Preset key in the Utility section.

Key Path	**Meas Setup**
Mode	VSA

Mode

See “Mode” on page 213in the section "Common Measurement Functions" for a description of this function.

Mode Setup

See “Mode Setup” on page 229 in the section "Common Measurement Functions" for a description of this function.

Peak Search

See “Peak Search” on page 406 in the section "Common Measurement Functions 2" for a description of this function.

Single

See “Single (Single Measurement/Sweep)” on page 263 in the section "Common Measurement Functions" for a description of this function.

Source

See “Source” on page 263 in the section "Common Measurement Functions" for a description of this function.

SPAN X Scale

See "SPAN X Scale" on page 416 in the section "Common Measurement Functions 2" for a description of this function.

Sweep/Control

See “Sweep/Control” on page 424 in the section "Common Measurement Functions 2" for a description of this function.

Trace/Detector

This section details the trace results accessible via the data key and also via SCPI, many of which are available in other measurements as well.

See “Trace/Detector” on page 428 in the section "Common Measurement Functions" for a description of this function.

Select Trace

See “Select Trace” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

Data

This key provides a menu of trace data choices for the selected trace. For the SCPI command, and other details, see Trace/Detector, “Data” on page 430.

The following trace data results are available for all modulation formats but FSK:

Trace data soft key name	**SCPI string form**	**Description**
Spectrum	"Spectrum1"	Averaged result of successive Inst Spectrum results (If RMS or Max averaging is on). Otherwise, FFT of current windowed Main (or Gate) Time
Inst Spectrum	"Inst Spectrum1"	Instantaneous Spectrum is the FFT of the current windowed Main (or Gate) Time. It is instantaneous in the sense that it isn't rms averaged, but it may included time-averaged data.
Search Time	"Search Time1"	Entire time data (after corrections) that will be searched (when Burst search or Sync search is on).
Time	"Time1"	Time data used as input to demodulation. If Burst or Sync search is on, this is the time data that fulfills the search criteria.
Raw Main Time	"Raw Main Time1"	Time record as it comes from the hardware, before software resampling or corrections
IQ Meas Time	"IQ Meas Time1"	Demodulated Time Trace
IQ Meas Spectrum	"IQ Meas Spec1"	Averaged result of successive Inst IQ Meas Spectrum if RMS or Max averaging is on. Otherwise, same as Inst IQ Meas Spectrum
Inst IQ Meas Spectrum	"Inst IQ Meas Spec1"	Instantaneous (not averaged) FFT of current IQ Meas Time
IQ Ref Time	"IQ Ref Time1"	Reconstructed ideal time waveform to compare IQ Meas Time against
IQ Ref Spectrum	"IQ Ref Spec1"	Averaged result of successive Inst IQ Ref Spectrum if RMS or Max averaging is on. Otherwise, same as Inst IQ Ref Spectrum

Trace data soft key name	SCPI string form	Description
Inst IQ Ref Spectrum	"Inst IQ Ref Spec1"	Instantaneous (not averaged) FFT of IQ Ref Time
Error Vector Time	"Error Vector Time1"	Vector difference between IQ Meas Time and IQ Ref Time at each point in time.
Error Vector Spectrum	"Error Vector Spec1"	Averaged result of Inst Error Vector Spectrum if RMS or Max averaging is on. Otherwise, same as Inst Error Vector Spectrum.
Inst Error Vector Spectrum	"Inst Err Vect Spec1"	FFT of Error Vector Time
IQ Mag Error	"IQ Mag Error1"	Difference in length of the IQ Meas Time vector and IQ Ref Time vector at each point in time. Expressed as a % of Ref Time length.
IQ Phase Error	"IQ Phase Error1"	Difference in phase of the IQ Meas Time vector and IQ Ref Time vector at each point in time.
Equalizer Impulse Response	"Eq Impulse Response1"	Impulse response of the adaptive equalizer (no data is available if equalizer is off)
Channel Frequency Response	"Ch Frequency Response1"	FFT of Equalizer Freq Response
Symbols/Errors	"Syms/Errs1"	Shows table of error statistics and a listing of symbol data. Only symbol results can be obtained using CALC:DDEM:DATA (see Table Data for how to retrieve tabular results).
No Data	"No Data"	Blank Trace

If the modulation format is FSK, then the following replace the IQ measurement and reference time and spectrum data, and error vector magnitude data:

FSK Meas Time	"FSK Meas Time1"	Demodulated Time Trace
FSK Meas Spectrum	"FSK Meas Spec1"	Averaged result of successive Inst FSK Meas Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Meas Spectrum
Inst FSK Meas Spectrum	"Inst FSK Meas Spec1"	Instantaneous (not averaged) FFT of FSK Meas Time
FSK Ref Time	"FSK Ref Time1"	Reconstructed ideal time waveform to compare FSK Meas Time against
FSK Ref Spectrum	"FSK Ref Spec1"	Averaged result of successive Inst FSK Ref Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Ref Spectrum
Inst FSK Ref Spectrum	"Inst FSK Ref Spec1"	Instantaneous (not averaged) FFT of FSK Ref Time
FSK Error Time	"FSK Error Time1"	Difference between FSK Meas Time and FSK Ref Time at each point in time.

FSK Error Spectrum	"FSK Error Spec1"	Averaged result of successive Inst FSK Error Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Error Spectrum.
Inst FSK Error Spectrum	"Inst FSK Err Spec1"	Instantaneous (not averaged) FFT of FSK Error Spectrum
Carrier Mag Error	"Carrier Mag Error1"	Amplitude error of carrier, relative to average amplitude.

For more information see: Trace/Detector, “Data” on page 430

Key Path	**Trace/Detector**
Mode	VSA

Pre-demod

Displays a menu that allows you to select a channel for assignment of trace Data.

Key Path	**Trace/Detector, Data,**
Mode	VSA

Spectrum

See Trace/Detector, Data, “Spectrum” on page 431 in the section "Common Measurement Functions 2" for more information.

Inst Spectrum

See Trace/Detector, Data, “Inst Spectrum” on page 433 in the section "Common Measurement Functions 2" for more information.

Search Time

Entire time data (after corrections) that will be searched (when Burst search or Sync search is on).

Key Path	**Trace/Detector, Data, Pre-demod**
Mode	VSA

Time

Time data used as input to demodulation. If Burst or Sync search is on, this is the time data that fulfills the search criteria.

Key Path	**Trace/Detector, Data, Pre-demod**
Mode	VSA

Raw Main Time

See Trace/Detector, Data, “Raw Main Time” on page 436 in the section "Common Measurement Functions 2" for more information.

Demod

Key Path	**Trace/Detector, Data,**
Mode	VSA

IQ Meas Time

Demodulated Time Trace.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

IQ Meas Spectrum

Averaged result of successive Inst IQ Meas Spectrum if RMS or Max averaging is on. Otherwise, same as Inst IQ Meas Spectrum.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Inst IQ Meas Spectrum

Instantaneous (not averaged) FFT of current IQ Meas Time.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

IQ Ref Time

Reconstructed ideal time waveform to compare IQ Meas Time against.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

IQ Ref Spectrum

Averaged result of successive Inst IQ Ref Spectrum if RMS or Max averaging is on. Otherwise, same as Inst IQ Ref Spectrum.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Inst IQ Ref Spectrum

Instantaneous (not averaged) FFT of IQ Ref Time.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

FSK Meas Time

Demodulated Time Trace.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

FSK Meas Spectrum

Averaged result of successive Inst FSK Meas Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Meas Spectrum.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Inst FSK Meas Spectrum

Instantaneous (not averaged) FFT of FSK Meas Time.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

FSK Ref Time

Reconstructed ideal time waveform to compare FSK Meas Time against.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

FSK Ref Spectrum

Averaged result of successive Inst FSK Ref Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Ref Spectrum.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Inst FSK Ref Spectrum

Instantaneous (not averaged) FFT of FSK Ref Time.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

DemodError

Key Path	**Trace/Detector, Data,**
Mode	VSA

Error Vector Time

Vector difference between IQ Meas Time and IQ Ref Time at each point in time.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

Error Vector Spectrum

Averaged result of Inst Error Vector Spectrum if RMS or Max averaging is on. Otherwise, same as Inst Error Vector Spectrum.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

Inst Error Vector Spectrum

FFT of Error Vector Time.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

IQ Mag Error

Difference in length of the IQ Meas Time vector and IQ Ref Time vector at each point in time. Expressed as a % of Ref Time length.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

IQ Phase Error

Difference in phase of the IQ Meas Time vector and IQ Ref Time vector at each point in time.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

FSK Error Time

Difference between FSK Meas Time and FSK Ref Time at each point in time.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

FSK Error Spectrum

Averaged result of successive Inst FSK Error Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Error Spectrum.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

Inst FSK Error Spectrum

Instantaneous (not averaged) FFT of FSK Error Spectrum.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

Carrier Mag Error

mplitude error of carrier, relative to average amplitude.

Key Path	**Trace/Detector, Data, DemodError**
Mode	VSA

Table data

One table is available in the Digital Demod measurement. It is displayed when you choose Symbols/Errors as trace data. The available tabular data changes depending on the modulation format chosen (see Meas Setup, Digital Demod, Format). These values may be obtained using the CALC:DDEM:DATA:TABL commands (see

Result name	Available in Demod Format:	Displayed Unit	Remote Name	Remote Unit
EVM (rms)	All but FSK	%rms	EvmRms	%rms

Result name	**Available in Demod Format:**	**Displayed Unit**	**Remote Name**	**Remote Unit**
EVM (peak)	All but FSK	%pk	EvmPeak	%pk
EVM (peak) symbol number	All but FSK		EvmPeakSym	
Offset EVM (rms)	OQPSK	%rms	OffsetEvmRms	%rms
Offset EVM (peak)	OQPSK	%pk	OffsetEvmPeak	%pk
Offset EVM (peak) symbol number	OQPSK		OffsetEvmPeakSym	
FSK error (rms)	FSK	%rms	FskErrRms	%rms
FSK error(peak)	FSK	%pk	FskErrPeak	%pk
FSK error (peak) symbol number	FSK		FskErrPeakSym	
Mag error (rms)	All	%rms	MagErrRms	%rms
Mag error (peak)	All	%pk	MagErrPeak	%pk
Mag error (peak) symbol number	All		MagErrPeakSym	
Phase error (rms)	All but FSK	deg	PhaseErrRms	deg
Phase error (peak)	All but FSK	deg	PhaseErrPeak	deg
Phase error (peak) symbol number	All but FSK		PhaseErrPeakSym	
Frequency Error	All but FSK	Hz	FreqErr	Hz
Carrier Offset	FSK	Hz	FskCarrOffs	Hz
SNR(MER)	QPSK, QAM, APSK, VSB	dB	SigToNoise	dB
FSK Deviation	FSK	Hz	FskDev	Hz
Pilot Level	8VSB	dB	PilotLevel	dB
TimeOffset	APSK (triggered)	s	TimeOffset	s
IQ Offset	All but FSK or VSB	dB	IqOffset	dB
Amplitude Droop	MSK2, PSK (except QPSK, OQPSK)	dB/sym	AmpDroop	dB/sym
Rho	QPSK, OQPSK		Rho	
Quadrature Error	All but BPSK, VSB, FSK	deg	QuadErr	deg

Result name	Available in Demod Format:	Displayed Unit	Remote Name	Remote Unit
IQ Gain Imbalance	All but BPSK, VSB, FSK	dB	IqGainImbalance	dB
Ring2 to Ring1 Ratio	APSK		R2Ratio	
Ring3 to Ring1 Ratio	APSK32		R3Ratio	
Peak EVM (rms)	EDGE	%	PeakEvmRms	%
95% EVM	EDGE	%	NinetyFivePercentEvm	%

Key Path	**Trace/Detector**
Mode	VSA

Response

Key Path	**Trace/Detector, Data,**
Mode	VSA

Equalizer Impulse Response

Impulse response of the adaptive equalizer (no data is available if equalizer is off).

Key Path	**Trace/Detector, Data, Response**
Mode	VSA

Channel Frequency Response

FFT of Equalizer Freq Response.

Key Path	**Trace/Detector, Data, Response**
Mode	VSA

Format

This key provides a menu of Trace Formats from which to choose for the selected trace.

See Trace/Detector, “Format” on page 443 in the section "Common Measurement Functions 2" for more information.

Digital Demod Trace Setup

This key provides a menu that allows you to set Digital Demod parameters for the selected trace.

See Trace/Detector, “Digital Demod Trace Setup” on page 444 in the section "Common Measurement Functions 2" for more information.

Copy to Data Register

This key provides a menu of Data Registers numbered from 1 to 6 into which to copy the selected trace.

See Trace/Detector, “Copy to Data Register” on page 450 in the section "Common Measurement Functions 2" for more information.

Phase/Delay Properties

This key provides a menu that allows you to set Phase and Delay properties for the selected trace.

See Trace/Detector, “Phase/Delay Properties” on page 451 in the section "Common Measurement Functions 2" for more information.

ACP Setup

This key provides a menu that allows you to set ACP setup parameters for the selected trace.

See Trace/Detector, “ACP Setup” on page 453 in the section "Common Measurement Functions 2" for more information.

OBW Setup

This key provides a menu that allows you to set OBW setup parameters for the selected trace.

See Trace/Detector, “OBW Setup (Occupied Bandwidth)” on page 463 in the section "Common Measurement Functions 2" for more information.

Trace Indicator Info

Pressing this key invokes the display of the currently selected trace indicator in the MSG bar at the bottom of the screen.

See Trace/Detector, “Trace Indicator Info” on page 469 in the section "Common Measurement Functions 2" for more information.

Trigger

Triggering is used to determine when a measurement should start taking data. There are several available trigger sources. For each trigger source, there are associated setup parameters. Typically, a trigger event is generated when a signal (or a characteristic of the signal) crosses a defined trigger level (or threshold) on a rising or falling slope. The measurement begins at a specified time delay from the trigger point. The delay may be negative, allowing pretrigger data to be taken. Each trigger source has associated its own trigger level, slope, and delay settings.

See "Trigger" on page 470 in the section "Common Measurement Functions 2" for a description of this function.

View/Display (View Presets)

The View/Display key provides access to a menu that enable you to select display parameters for the current measurement.

For more information on other View/Display functions (Display and Layout) see Analyzer Setup, View/Display

View Presets affect the trace layout, trace data assignment, scaling and formatting but do not affect hardware measurement setup.

Remote Command	`:DISPlay:DDEMod:VIEW:PRESet QUAD`
Example	DISP:DDEM:VIEW:PRES QUAD
Key Path	**View/Display**
Mode	VSA

Display

See “Display” on page 349 in the section "Common Measurement Functions" for a description of this function.

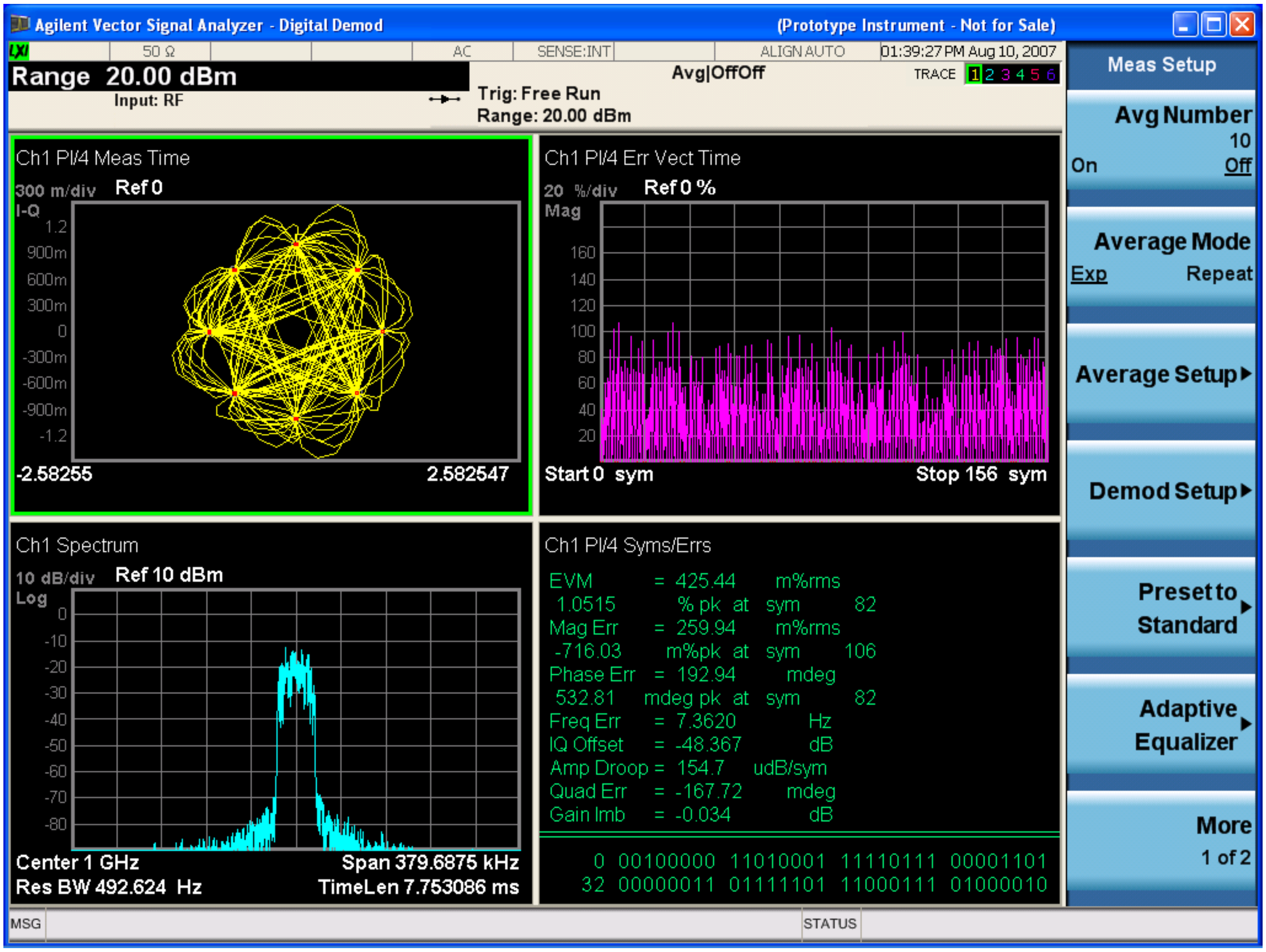
Layout

See “Layout” on page 479 in the section "Common Measurement Functions 2" for a description of this function.

Preset View: Demod Quad

This preset displays a quad layout with the IQ Meas Time in trace 1, Spectrum in trace 2, Error Vector Time in trace 3, and the Symbol/Error table in trace 4.

Key Path	**View/Display**
Mode	VSA


Agilent Vector Signal Analyzer - Digital Demod
(Prototype Instrument - Not for Sale)
50 Ω
AC
SENSE:INT
ALIGN AUTO
01:39:27 PM Aug 10, 2007
Range 20.00 dBm
Input: RF
Avg|OffOff
TRACE 1 2 3 4 5 6
Trig: Free Run
Range: 20.00 dBm
Meas Setup
Avg Number
10
On Off
Average Mode
Exp Repeat
Average Setup
Demod Setup
Preset to Standard
Adaptive Equalizer
More
1 of 2
Ch1 PI/4 Meas Time
300 m/div Ref 0
I-Q
1.2
900m
600m
300m
0
-300m
-600m
-900m
-1.2
-2.58255
2.582547
Ch1 PI/4 Err Vect Time
20 %/div Ref 0 %
Mag
160
140
120
100
80
60
40
20
Start 0 sym
Stop 156 sym
Ch1 Spectrum
10 dB/div Ref 10 dBm
Log
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 1 GHz
Span 379.6875 kHz
Res BW 492.624 Hz
TimeLen 7.753086 ms
Ch1 PI/4 Syms/Errs
EVM = 425.44 m%rms
1.0515 % pk at sym 82
Mag Err = 259.94 m%rms
-716.03 m%pk at sym 106
Phase Err = 192.94 mdeg
532.81 mdeg pk at sym 82
Freq Err = 7.3620 Hz
IQ Offset = -48.367 dB
Amp Droop = 154.7 udB/sym
Quad Err = -167.72 mdeg
Gain Imb = -0.034 dB
0 00100000 11010001 11110111 00001101
32 00000011 01111101 11000111 01000010
MSG
STATUS

10 WLAN DSSS

This key selects the VSA WLAN DSSS measurement.

This topic contains the following sections:

“Remote Command Results for VSA WLAN DSS Measurement” on page 397

“Front Panel Results” on page 400

Remote Command Results for VSA WLAN DSS Measurement

All of the scalar results for this measurement are contained one table and hence one equivalent subopcode for the remote results. The remote user can use this equivalence by either visually inspecting the corresponding summary trace on the display, or by using CALC:DATA queries which programmatically describe the corresponding summary trace.

`:CONFigure:W11B`

`:CONFigure:W11B:NDEFault`

`:FETCh:W11B[n]?`

`:INITiate:W11B`

`:MEASure:W11B[n]?`

`:READ:W11B[n]?`

This standard remote result is also available thru the CALC:DATA<n> set of queries, where <n> is a reference to the trace number. The results assigned to each trace vary depending on which tests are enabled. As an example, with the default trace layout, these results in the Error Summary results are returned by CALC:W11B:DATA4:TABLE? See Common Functions, Data Queries, CALCulate:DATA for more details.

The following table denotes the VSA WLAN DSSS specific results returned from the (FETCh|MEASure|READ):W11B commands, and their corresponding CALC:DATA queries, indexed by subopcode.

Note that valid results are only returned if the Symbols/Errors trace is being computed. It must be selected though it is not necessary for it to be shown in the current Layout.

Note that there are more results available that are supported by the VSA Mode. These are documented under Common Functions, Data Queries, MEASure, READ, FETCh.

Results table (with subopcodes):

N	Results Returned
Not specified or n=1	Returns 22 comma-separated scalar results, corresponding exactly to the items returned in the Error Summary: 1. EVM (% rms) 2. EVM Peak (% peak) 3. EVM Peak Location (chip) 4. Magnitude Error (%rms) 5. Magnitude Error Peak (%) 6. Magnitude Error Peak Location (chip) 7. Phase Error (deg) 8. Phase Error Peak (deg) 9. Phase Error Peak Location (chip) 10. Frequency Error (Hz) 11. IQ Offset (ratio) 12. IQ Quadrature Error (deg) 13. IQ Gain Imbalance (ratio) 14. Sync Correlation (1.0 = ideal) 15. 802.11b EVM Peak (%) 16. Header Status (see below) 17. Mac Status (see below) 18. Burst Type (see below) 19. Bit Rate (bps) 20. Octets 21. Data Time Length (sec) 22. Symbol Clock Error (ratio) If the results are not available, NaN (9.91e37) is returned.

In addition to these results, other results are defined in Common Functions, Data Queries, MEASure, READ, FETCh.

Header Status enumerations:

Enumeration	Meaning
0	No SFD found - the Preamble Start Frame Delimiter was not found.

Enumeration	Meaning
1	Invalid header bits - some of the bits in the PLCP Header were incorrect, but the analyzer was able to determine the data length and data modulation format.
2	Header CRC failed - the header looked correct except for the CRC, which did not match the rest of the header data.
3	Invalid header phase shift - an extra (incorrect) 90 degree phase shift was detected at the start of the header.
4	Invalid Barker1/short - the detected burst type is 1MB/sec Barker with a short preamble, which is an invalid format.
5	Unknown - the result length was not long enough to capture all of the header data, so the status can not be determined.
6	OK - the header appears correct and the CRC passed.

Mac Status enumerations:

Enumeration	Meaning
0	Unknown - the result length was not long enough to capture all of the data, so the MAC status can not be determined.
1	MAC FCS failed - the MAC frame checksum failed.
2	OK - the MAC frame checksum passed.

Burst Type enumerations:

NOTE The Burst Type value encodes whether the preamble is the "long format" or "short format", which affects the output value. If the long preamble format is detected, the values are the first number shown. If a short preamble format is detected, 4096 is added to the "long format" value and shown in (parentheses).

Enumeration	Meaning
0 (4096)	1 Mbit/sec Barker spreading (BPSK chips)
1 (4097)	2 Mbit/sec Barker spreading (QPSK chips)
2 (4098)	5.5 Mbit/sec CCK modulation (QPSK chips)
3 (4099)	11 Mbit/sec CCK modulation (QPSK chips)
4 (4100)	5.5 Mbit/sec PBCC modulation (QPSK chips)
5 (4101)	11 Mbit/sec PBCC modulation (QPSK chips)
6 (4102)	22 Mbit/sec PBCC modulation (8PSK chips)

Enumeration	Meaning
7 (4103)	33 Mbit/sec PBCC modulation (8PSK chips at 16.5 MHz)
8 (4104)	DSSS-OFDM modulation (OFDM symbols)
9 (4105)	Unknown modulation format

Key Path	**Meas**
Mode	VSA

Front Panel Results

VSA WLAN DSSS results may be displayed in any trace, and the traces viewed in a variety of layouts that show 1, 2, 3, or 4 traces at a time. Each trace may be scaled as desired regardless of measurement settings, or auto-scaled to reflect measurement settings. Data may be formatted in a variety of ways. (For example, you may view the log magnitude of complex data, the real or imaginary part, etc.) You may use Preset View:Basic or other Preset Views to view frequently used results, or to provide a familiar starting point from which you may customize your own view.

AMPTD Y Scale

See “AMPTD Y Scale (Amplitude)” on page 361 in the section "Common Measurement Functions 2" for for a description of this function.

Auto Couple

See “Auto Couple” on page 33 in the section "Common Measurement Functions" for a description of this function.

BW

See “BW (Bandwidth)” on page 368 in the section "Common Measurement Functions 2" for a description of this function.

FFT Window

See “FFT Window” on page 371 in the section "Common Measurement Functions 2" for a description of this function.

Cont (Continuous)

See “Cont (Continuous Measurement/Sweep)” on page 35 in the section "Common Measurement Functions 1" for a description of this function.

FREQ Channel

See “FREQ Channel” on page 371 in the section "Common Measurement Functions 2" for a description of this function.

Input/Output

See “Input/Output” on page 43 in the section "Common Measurement Functions " for a description of this function.

Marker

See “Marker” on page 374 in the section "Common Measurement Functions 2" for a description of this function.

Marker Function

See “Marker Function” on page 392 in the section "Common Measurement Functions 2" for a description of this function.

Marker To

See “Marker -> (Marker To)” on page 390 in the section "Common Measurement Functions 2" for a description of this function.

Meas (Measure)

See “Meas” on page 155 in the section "Common Measurement Functions " for a description of this function.

Meas Setup

The common Meas Setup functions are documented in “Meas Setup” on page 400 in the section "Common Measurement Functions 2".

Key Path	**Front Panel**
Mode	VSA

Demod Setup

This key brings up a menu of commonly used demodulation setup parameters.

Key Path	**Meas Setup**
Mode	VSA

Data Modulation Detect

This key allows you to select whether the data modulation format is automatically detected or manually set to a particular data modulation format.

When set to Auto, the SIGNAL and SERVICE field data within the PLCP Header are used to determine the data modulation format. When set to Manual, it is forced to be the value set by Mod Format.

Remote Command	`[:SENSe]:W11B:DEMod:AUTO OFF|ON|0|1` `[:SENSe]:W11B:DEMod:AUTO?`
Coupling	Set to Default by Preset to Standard.
Example	W11B:DEM:AUTO ON
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	ON
State Saved	Saved in instrument state.

Mod Format

This key sets the modulation format that is forced to be used when Data Modulation Detect is set to Manual.

Remote Command	`[:SENSe]:W11B:DEMod DSSS1M|DSSS2M|CCK5M5|CCK11M|PBCC5M5|PBCC11M|PBCC22M|PBCC33M` `[:SENSe]:W11B:DEMod?`

Coupling	Set to Default by Preset to Standard.
Example	W11B:DEM DSSS1M
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	DSSS1M
State Saved	Saved in instrument state.
Range	1 Mbps DSSS | 2 Mbps DSSS | 5.5 Mbps CCK | 11 Mbps CCK | 5.5 Mbps PBCC | 11 Mbps PBCC | 22 Mbps PBCC | 33 Mbps PBCC

DSSS Formats

This key brings up a selection of the available DSSS Modulation Formats.

Key Path	**Meas Setup, Demod Setup, Mod Format**
Mode	VSA

1 Mbps DSSS

Selects 1 Mbps 11 Chip DSSS Barker DBPSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, DSSS Formats**
Mode	VSA

2 Mbps DSSS

Selects 2 Mbps 11 Chip DSSS Barker DQPSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, DSSS Formats**
Mode	VSA

CCK Formats

This key brings up a selection of the available CCK Modulation Formats.

Key Path	**Meas Setup, Demod Setup, Mod Format**
Mode	VSA

5.5 Mbps CCK

Selects 5.5 Mbps 8 Chip CCK DQPSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, CCK Formats**
Mode	VSA

11 Mbps CCK

Selects 11 Mbps 8 Chip CCK DQPSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, CCK Formats**
Mode	VSA

PBCC Formats

This key brings up a selection of the available PBCC Modulation Formats.

Key Path	**Meas Setup, Demod Setup, Mod Format**
Mode	VSA

5.5 Mbps PBCC

Selects 5.5 Mbps PBCC QPSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, PBCC Formats**
Mode	VSA

11 Mbps PBCC

Selects 11 Mbps PBCC QPSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, PBCC Formats**
Mode	VSA

22 Mbps PBCC

Selects 22 Mbps PBCC 8PSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, PBCC Formats**
Mode	VSA

33 Mbps PBCC

Selects 33 Mbps PBCC 8PSK Data Modulation Format.

Key Path	**Meas Setup, Demod Setup, Mod Format, PBCC Formats**
Mode	VSA

Reference Filter

Selects the Reference Filter, as well as the companion Measurement Filter.

The following table shows what Measurement filter is used for each selected Reference Filter.

ReferenceFilter	**CompanionMeasurement Filter**
Rect (none)	Rect (none)
Gaussian	Rect (none)
Raised Cosine	Root Raised Cosine (RRC)

The 802.11b standard specifies that no reference filter should be used when computing EVM. However, a transmitter must use a transmit filter in order to meet the 802.11b spectral mask requirement, so it may be useful to specify a reference filter when computing EVM.

Remote Command	`[:SENSe]:W11B:FILTer:REFerence RECTangular|GAUSsian|RCOSine` `[:SENSe]:W11B:FILTer:REFerence?`
Coupling	Set to Default by Preset to Standard.
Example	W11B:FILT:REF RECT
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	RECT
State Saved	Saved in instrument state.
Range	Rectangular | Gaussian | Raised Cosine

Rectangular

Selects the Rectangular (no) Reference Filter and the Rectangular (no) Measurement Filter

Key Path	**Meas Setup, Demod Setup, Data Modulation, Reference Filter**
Mode	VSA

Gaussian

Selects the Gaussian Reference Filter and the Rectangular (no) Measurement Filter

Key Path	**Meas Setup, Demod Setup, Data Modulation, Reference Filter**
Mode	VSA

Raised Cosine

Selects the Raised Cosine Reference Filter and the Root Raised Cosine (RRC) Measurement Filter

Key Path	**Meas Setup, Demod Setup, Data Modulation, Reference Filter**

Mode	VSA

Alpha / BT

If you specify a Gaussian Reference Filter, you can set the BT (Bandwidth Time Product) for the filter. If you specify a Raised Cosine Reference Filter, you can set the Alpha for the filter.

BT describes the shape of a Gaussian filter. BT indicates the filter roll-off (or excess bandwidth) of the Gaussian filter.

Alpha describes the shape of a Nyquist (raised cosine) filter. Alpha is also called the roll-off or the excess bandwidth factor. A higher value for alpha increases the bandwidth that is used in excess of the theoretical minimum.

Remote Command	`[:SENSe]:W11B:ALPHa <real>` `[:SENSe]:W11B:ALPHa?`
Coupling	Set to Default by Preset to Standard.
Example	W11B:ALPH 0.5
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	0.5
State Saved	Saved in instrument state.
Min	.05
Max	100.0 (Gaussian Reference Filter), 1.0 (Raised Cosine Reference Filter)

Preset to Standard

This immediately sets all measurement parameters to their Preset values. This is the same as Meas Preset except that the display state is left alone.

Remote Command	`[:SENSe]:W11B:STANdard:PRESet I11BGDSSS`
Example	W11B:STAN:PRES I11BGDSSS
Key Path	**Meas Setup**
Mode	VSA
Notes	The parameter is required although there is only one choice.

Meas Time

This key brings up a menu consisting of the time length and positioning demodulation setup parameters.

Key Path	**Meas Setup**

Mode	VSA

Search Length

Lets you specify the length of time to acquire the input signal (in seconds). This defines the length of time that the pulse search is performed.

The analyzer searches within the specified search length and demodulates the first complete pulse (burst). The pulse can occur anywhere within the search length. Pulses beyond the first complete pulse are disregarded and are not demodulated. In order for the pulse search algorithm to detect a pulse edge, the pulse must be at least 15 dB above the noise floor. The resultant pulse is then demodulated.

Even if no pulse is found, the analyzer will attempt to demodulate starting at the beginning of the Search Length. If a PLCP Preamble Sync pattern is found near the start of the search length, the demodulation will be correct.

Remote Command	`[:SENSe]:W11B:SYNC:SLENgth <time>` `[:SENSe]:W11B:SYNC:SLENgth?`
Coupling	The minimum is constrained to meet the number of chip requirements of Result Length or Max Auto Result Length, whichever is active, at the current Chip Rate. Set to Default by Preset to Standard.
Example	W11B:SYNC:SLEN 0.001
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	1.0 ms
State Saved	Saved in instrument state.
Min	.001 ms
Max	33.70373 ms

Result Length

This key allows you to manually set the Result Length or to have it automatically detected.

The result length is the total number of chips included in the acquired and demodulated data and includes the PLCP Preamble and Header.

When Result Length is Automatic, the result length is the number of chips in the current burst, up to the limit of Max Auto Result Length.

Note that when Result Length is Manual, the demodulation is not limited to the number of chips transmitted within the burst as is done when the Result Length is Auto. The analyzer will demodulate the total number of chips specified by Result Length, which if longer than the burst, could lead to unexpected and incorrect data results.

Remote Command	`[:SENSe]:W11B:TIME:RESult:LENGth <integer>`
	`[:SENSe]:W11B:TIME:RESult:LENGth?`
	`[:SENSe]:W11B:TIME:RESult:AUTO OFF|ON|0|1`
	`[:SENSe]:W11B:TIME:RESult:AUTO?`

Coupling	Search Length is increased to include the Result Length, if Result Length is in Manual mode. Set to Default by Preset to Standard.
Example	W11B:TIME:RES:LENG 2816 W11B:TIME:RES:AUTO ON
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	2816 chips ON
State Saved	Saved in instrument state.
Min	1 chip
Max	65941 chips

Max Auto Result Length

This key has an effect only when Result Length is set to Auto. In this case, the effective result length, the total number of chips included in the demodulated data, is automatically determined by comparing the input signal's chip length to the Max Auto Result Length value and using the smaller number.

Remote Command	`[:SENSe]:W11B:TIME:RESult:MAX <integer>` `[:SENSe]:W11B:TIME:RESult:MAX ?`
Coupling	Search Length is increased to include the Max Result Length, if Result Length is in Auto mode. Set to Default by Preset to Standard.
Example	W11B:TIME:RESult:MAX 2816
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	2816 chips
State Saved	Saved in instrument state.
Min	1 chip
Max	370741 chips

Meas Offset

Measurement Offset determines the start position, in chips, of the Meas Interval with respect to the first Chip of the PLCP Preamble. Measurement Interval is entered in chips, which is rounded to the nearest whole number of data symbols, as determined from the input signal's data modulation format.

Remote Command	`[:SENSe]:W11B:TIME:OFFSet <integer>` `[:SENSe]:W11B:TIME:OFFSet?`
Coupling	The maximum is limited to Result Length or Max Auto Result Length, whichever is active, minus Meas Interval. Set to Default by Preset to Standard.
Example	W11B:TIME:OFFS 22
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	22 chips
State Saved	Saved in instrument state.
Min	0 chips
Max	See coupling

Meas Interval

Measurement Interval, in conjunction with Meas Offset, lets you specify an interval (segment) of the result length data to be demodulated and analyzed. Measurement Interval is entered in chips, which is rounded to the nearest whole number of data symbols, as determined from the input signal's data modulation format.

Remote Command	`[:SENSe]:W11B:TIME:INTerval <integer>` `[:SENSe]:W11B:TIME:INTerval?`
Coupling	The maximum is limited to Result Length or Max Auto Result Length, whichever is active. If necessary, Meas Offset is reduced to keep Meas Interval plus Meas Offset within Result Length or Max Result Length, whichever is active. Set to Default by Preset to Standard.
Example	W11B:TIME:INT 2794
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	2794 chips
State Saved	Saved in instrument state.
Min	1

Max	See coupling

Advanced

This key accesses a menu that allows you to select lesser used demodulation parameters for the current measurement. These settings are for advanced users and do not normally require adjustment for most common measurements.

Key Path	**Meas Setup, More**
Mode	VSA

Chip Rate

This key lets you set the Chip Rate for the analyzer's demodulator. This allows you the freedom to enter nonstandard chip rates for test and analysis purposes.

Remote Command	`[:SENSe]:W11B:CRATe <freq>` `[:SENSe]:W11B:CRATe?`
Coupling	Span is forced to be at least one tenth of the Chip Rate. So the maximum Chip Rate is one tenth of the maximum Span. Likewise, the Span will be forced to be within ten times the Chip Rate and so the minimum Span sets the minimum Chip Rate. Set to Default by Preset to Standard.
Example	W11B:CRAT 11.0E6
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	11 MHz
State Saved	Saved in instrument state.
Min	See Coupling
Max	See Coupling

Clock Adjust

Clock Adjust determines when the analyzer's digital demodulator samples the I/Q trajectory.

The demodulator used in this measurement does not require symbol-clock timing signals to determine the location of chip detection-decision points. Instead, the demodulator uses an algorithm to determine chip locations.

Some digital communications systems contain non-linearities that can bias the digital demodulator's estimation of the chip clock position. You can use clock adjust to compensate for this "offset" and obtain a lower EVM (Error Vector Magnitude).

Remote Command	`[:SENSe]:W11B:CADJust <real>` `[:SENSe]:W11B:CADJust?`
Coupling	Set to Default by Preset to Standard.
Example	W11B:CADJ 0.0
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	0 chips
State Saved	Saved in instrument state.
Min	–0.5 chips
Max	0.5 chips

Track Phase

The Track Phase parameter enables tracking of phase drift within the WLAN burst. This may be useful if the carrier frequency drifts significantly during a burst. Circular arcs in the constellation of the IQ Meas Time trace display is an indicator of phase drift. The Track Phase parameter can be used to remove the phase drift, which will improve the IQ constellation trace and reduce the EVM data results. Frequency drift can also cause poor equalizer performance, so selecting Track Phase may improve equalizer results.

Remote Command	`[:SENSe]:W11B:TRACk:PHASe OFF|ON|0|1` `[:SENSe]:W11B:TRACk:PHASe?`
Coupling	Set to Default by Preset to Standard.
Example	W11B:TRAC:PHAS OFF
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Equalizer

Equalizer State turns the Equalizer on or off.

The Equalizer numeric entry sets the length of the equalization filter.

In general, the best Equalizer filter length is the smallest that meets your measurement requirements. For measurements at the transmitter, the filter length may only need to be a few chips in length. Longer filter lengths may be needed to measure multi-path environments.

The 802.11b specification does not allow for equalization prior to computing EVM. This means that any linear distortion, such as group delay distortion in the IF, will increase EVM. When EVM is high the equalizer can be used as a diagnostic tool. If use of the equalizer significantly improves the EVM result, then the channel frequency response should be examined for flatness problems (i.e. group delay distortion). If it does not, then the problem is more likely related to noise, non-linear distortion, or spurious error.

Remote Command	`[:SENSe]:W11B:EQUalization:FLENgth <integer>`
	`[:SENSe]:W11B:EQUalization:FLENgth?`
	`[:SENSe]:W11B:EQUalization[:STATe] OFF|ON|0|1`
	`[:SENSe]:W11B:EQUalization[:STATe]?`

Coupling	The maximum Equalizer length is also limited to 2 chips less than the result length. Set to Default by Preset to Standard.
Restriction and Notes	Only odd values are valid. Even value entries are rounded down.
Example	W11B:EQU:FLEN 21 W11B:EQU OFF
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	21 OFF
State Saved	Saved in instrument state.
Min	3
Max	99

Descramble

Descramble Mode lets you enable/disable the WLAN 802.11b/g descrambler. With this feature you can separately view the descrambled or raw data bits for the preamble, header or payload data fields.

Remote Command	`[:SENSe]:W11B:DESCramble ALL|NONE|PREamble|PHEader` `[:SENSe]:W11B:DESCramble?`
Coupling	Set to Default by Preset to Standard.
Example	W11B:DESC ALL
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	ALL
Range	All | None | Preamble Only | Preamble & Header Only

All

The WLAN Descrambler is ON, the Preamble, Header, and Payload data bits are descrambled.

Key Path	**Meas Setup, More, Advanced, Descramble**
Mode	VSA

None

The WLAN Descrambler is OFF, the Preamble, Header, and Payload data bits are not descrambled.

Key Path	**Meas Setup, More, Advanced, Descramble**
Mode	VSA

Preamble Only

Only the Preamble data bits are descrambled. The Header data bits and Payload data bits are not descrambled.

Key Path	**Meas Setup, More, Advanced, Descramble**
Mode	VSA

Preamble & Header Only

Only the Preamble and Header data bits are descrambled. The Payload data bits are not descrambled.

Key Path	**Meas Setup, More, Advanced, Descramble**
Mode	VSA

IQ Normalize

When set to On, the IQ trace data results (including IQ Meas Time, IQ Ref Time, IQ Mag Err, IQ Phase Err, and Error Vector Time and corresponding Spectrum results) are normalized.

When set to Off, the trace data results are not normalized.

When normalization is On, the analyzer normalizes or scales the demodulated trace data results, in magnitude, to a nominal value of 1, relative to the outermost states of the ideal (IQ Reference) constellation diagram.

Note that regardless of this setting, the Error Summary trace data results are always normalized.

Remote Command	`:CALCulate:W11B:NORMalize OFF|ON|0|1` `:CALCulate:W11B:NORMalize?`
Coupling	Set to Default by Preset to Standard.
Example	CALC:W11B:NORM ON
Key Path	**Meas Setup, More, Advanced**

Mode	VSA
Preset	ON
State Saved	Saved in instrument state.

Meas Preset

This immediately sets all measurement parameters to their Preset values. This presets the display state in the same way as Preset View: Basic.

For more information, see the section under the Preset key in the Utility section.

Key Path	**Meas Setup, More**
Mode	VSA

Mode

See “Mode” on page 213in the section "Common Measurement Functions" for a description of this function.

Mode Setup

See “Mode Setup” on page 229 in the section "Common Measurement Functions" for a description of this function.

Peak Search

See “Peak Search” on page 406 in the section "Common Measurement Functions 2" for a description of this function.

Single

See “Single (Single Measurement/Sweep)” on page 263 in the section "Common Measurement Functions" for a description of this function.

Source

See “Source” on page 263 in the section "Common Measurement Functions" for a description of this function.

SPAN X Scale

See “SPAN X Scale” on page 416 in the section "Common Measurement Functions 2" for a description of this function.

Sweep/Control

See “Sweep/Control” on page 424 in the section "Common Measurement Functions 2" for a description of this function.

Trace/Detector

See “Trace/Detector” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

Select Trace

See “Select Trace” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

Data

This key provides a menu of trace data choices for the selected trace. For the SCPI command, and other details, see Trace/Detector, “Data” on page 430.

The following are the SCPI string forms for the Data types that are specific to this measurement, in alphabetical order:

Trace data soft key name	SCPI string form
CCDF	"CCDF1"
CDF	"CDF1"
Ch Frequency Response	"Ch Frequency Response1"
Eq Impulse Response	"Eq Impulse Response1"
Error Vector Spectrum	"Error Vector Spec1"
Error Vector Time	"Error Vector Time1"
Header Symbols	"Header Syms1"
IQ Mag Error	"IQ Mag Error1"
IQ Meas Spectrum	"IQ Meas Spec1"
IQ Meas Time	"IQ Meas Time1"
IQ Phase Error	"IQ Phase Error1"
IQ Ref Spectrum	"IQ Ref Spec1"
IQ Ref Time	“IQ Ref Time1”
Inst Error Vector Spectrum	"Inst Error Vect Spec1"
Inst IQ Meas Spectrum	"Inst IQ Meas Spec1"
Inst IQ Ref Spectrum	"Inst IQ Ref Spec1"
Inst Spectrum	"Inst Spectrum1"
PDF	"PDF1"

Trace data soft key name	SCPI string form
Preamble Symbols	"Preamble Syms1"
Raw Main Time	"Raw Main Time1"
Search Time	"Search Time1"
Spectrum	"Spectrum1"
Symbols/Errors	"Syms/Errs1"
Time	"Time1"

Pre Demod

This key accesses the Trace Data choices which show pre-demodulation results.

Key Path	**Trace/Detector, Data**
Mode	VSA

Spectrum

Averaged FFT of the Time waveform. See Trace/Detector, Data, Pre-demod, “Spectrum” on page 431 in the section "Common Measurement Functions 2" for more information.

Inst Spectrum

The FFT of the time waveform for the current measurement. “Inst” or Instantaneous refers to this result not being averaged like the Spectrum Trace Data result. See Trace/Detector, Data, Pre-demod, “Inst Spectrum” on page 433 in the section "Common Measurement Functions 2" for more information.

Search Time

The Search Length long time record acquired for the current measurement.

Key Path	**Trace/Detector, Data, Pre Demod**
Mode	VSA

Time

The time record before digital demodulation and after the pulse/burst search.

The starting point is the beginning of the burst, offset by the Meas Offset and its length is the Meas Interval.

The exception to this is that 10% more additional data on both sides is shown when the Measurement Offset is set to zero and the Measurement Interval is set the same as the Result Length in Manual Result Length mode. In automatic Result Length mode, this will occur when the Measurement Offset to zero and the Measurement Interval is set to the Max Result Length, but will not go more than 10% beyond the end of the burst.

Key Path	**Trace/Detector, Data, Pre Demod**

Mode	VSA

Raw Main Time

The raw time record acquired for the current measurement. This data is unprocessed and includes additional points acquired for settling of the filters involved in subsequent processing, such as the demodulation filtering. See Trace/Detector, Data, Pre-demod, “Raw Main Time” on page 436 in the section "Common Measurement Functions 2" for more information.

Statistical

This key accesses the Trace Data choices which show statistical results.

Key Path	**Trace/Detector, Data**
Mode	VSA

CCDF

The Complementary, Cumulative Density function (CCDF) for the selected input channel.

The analyzer plots CCDF using units of percent (%) for the y-axis and power (dB) for the x-axis. Power on the x-axis is relative to the signal average power. See Trace/Detector, Data, Statistical, “CCDF (Complementary, Cumulative Density Function)” on page 441 in the section "Common Measurement Functions 2" for more information.

CDF

The Cumulative Density Function (CDF) for the selected input channel. CDF is computed by integrating the CCDF (Probability Density Function). See Trace/Detector, Data, Statistical, “CDF (Cumulative Density Function)” on page 442 in the section "Common Measurement Functions 2" for more information.

PDF

The Probability Density Function (PDF) for the selected input channel. PDF indicates the probability that a given level has occurred. See Trace/Detector, Data, Statistical, “PDF (Probability Density Function)” on page 442 in the section "Common Measurement Functions 2" for more information.

Demod

This key accesses the Trace Data choices which show general demodulation results.

Key Path	**Trace/Detector, Data**
Mode	VSA

IQ Meas Time

The measured time data sampled at exactly the chip times with IQ origin offset, system gain normalization and carrier locking applied to the input signal.

Key Path	**Trace/Detector, Data, Demod**

Mode	VSA

IQ Meas Spectrum

The averaged frequency spectrum of IQ Meas Time. The selected FFT Window is applied and the FFT performed on the result. This is then averaged, if averaging is turned on.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Inst IQ Meas Spectrum

The instantaneous (non-averaged) frequency spectrum of IQ Meas Time. The selected FFT Window is applied and the FFT performed on the result.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

IQ Ref Time

The ideal representation of the measured input signal (IQ Meas Time).

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

IQ Ref Spectrum

The averaged frequency spectrum of IQ Ref Time. The selected FFT Window is applied and the FFT performed on the result. This is then averaged, if averaging is turned on.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Inst IQ Ref Spectrum

The instantaneous (non-averaged) frequency spectrum of IQ Ref Time. The selected FFT Window is applied and the FFT performed on the result.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Demod Error

This key accesses the Trace Data choices which show demodulation error related results.

Key Path	**Trace/Detector, Data**

Mode	VSA

Error Vector Time

The vector (IQ) difference between the IQ Meas Time and IQ Ref Time signals.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Error Vector Spectrum

The averaged frequency spectrum of Error Vector Time. The selected FFT Window is applied and the FFT performed on the result. This is then averaged, if averaging is turned on.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Inst Error Vector Spectrum

The instantaneous (non-averaged) frequency spectrum of Error Vector Time. The selected FFT Window is applied and the FFT performed on the result.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

IQ Mag Error

The difference, in magnitude, between the IQ Meas Time and IQ Ref Time signals.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

IQ Phase Error

The phase difference between the IQ Meas Time and IQ Ref Time signals.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Tables

This key accesses the Trace Data choices which are in tabular form, including demodulated symbols tables.

Key Path	**Trace/Detector, Data**
Mode	VSA

Symbols/Errors

This display contains an error summary in the upper part, and a listing of demodulated symbols in the lower part. The error summary consists of:

Result name	**Displayed Unit**	**Remote Name**	**Remote Unit**
EVM (rms)	%rms	EVM	%rms
EVM (peak)	%pk	EVMPeak	%
EVM (peak) location	chip	EVMPeakLoc	chip
Mag error (rms)	%rms	MagErr	%rms
Mag error (peak)	%pk	MagErrPeak	%
Mag error (peak) location	chip	MagErrPeakLoc	chip
Phase error (rms)	deg	PhaseErr	deg
Phase error (peak)	deg	PhaseErrPeak	deg
Phase error (peak) location	chip	PhaseErrPeakLoc	chip
Frequency Error	Hz	FreqErr	Hz
IQ Offset	dB	IQOffset	(none)
Quadrature Error	deg	IQQuadErr	deg
Gain Imbalance	dB	IQGainImb	(none)
Sync Correlation		SyncCorr	(none)
802.11b 1000 chip Peak EVM	%	80211bEvmPeak	%
Status		HdrStat	(none)
(included in Status above)		MacStat	(none)
Burst Type		BurstType	(none)
Bit Rate	bps	BitRate	bps
Octets		Octets	(none)
Data Len	sec	DataTimeLen	sec
Symbol Clock Err	ppm	SymClkErr	(none)

The error summary values may be obtained using the CALC:W11B:DATA:TABL commands.

The demodulated symbols are available as the data values for this trace and so may be accessed using the CALCulate:W11B:DATA command. See Common Functions, Data Queries, CALCulate:DATA for more details.

Key Path	**Trace/Detector, Data, Tables**

Mode	VSA

Preamble Symbols

This trace shows the 802.11b PLCP Preamble data bits.

Key Path	**Trace/Detector, Data, Tables**
Mode	VSA

Header Symbols

This trace shows the 802.11b PLCP Header data bits.

Key Path	**Trace/Detector, Data, Tables**
Mode	VSA

Response

This key accesses the Trace Data choices which show equalizer response results.

Key Path	**Trace/Detector, Data**
Mode	VSA

Ch Frequency Response

When the Equalizer is On, this trace shows the frequency response of the channel for which the equalizer is correcting. Ch Frequency Response is computed as the inverse of the equalization filter's frequency response.

Key Path	**Trace/Detector, Data, Response**
Mode	VSA

EQ Impulse Response

When the Equalizer is On, the EQ Impulse Response trace shows the impulse response computed from the 802.11b or 802.11g preamble.

Key Path	**Trace/Detector, Data, Response**
Mode	VSA

ACP

This brings up a selection of the ACP result traces. See Trace/Detector, Data, “ACP Setup” on page 453 in the section "Common Measurement Functions 2" for more information.

OBW

This brings up a selection of the OBW result traces. See Trace/Detector, Data, “OBW Setup (Occupied Bandwidth)” on page 463 in the section "Common Measurement Functions 2" for more information.

Register

This brings up a selection of the Data Registers. See Trace/Detector, Data, “Register” on page 468 in the section "Common Measurement Functions 2" for more information.

No Data

A blank display is shown.

Format

See “Format” on page 443 in the section "Common Measurement Functions 2" for a description of this function.

Digital Demod Trace Setup

See “Digital Demod Trace Setup” on page 444 in the section "Common Measurement Functions 2" for a description of this function.

Copy to Data Register

See “Copy to Data Register” on page 450 in the section "Common Measurement Functions 2" for a description of this function.

Phase/Delay Properties

See “Phase/Delay Properties” on page 451 in the section "Common Measurement Functions 2" for a description of this function.

ACP Setup

See “ACP Setup” on page 453 in the section "Common Measurement Functions 2" for a description of this function.

OBW Setup

See “OBW Setup (Occupied Bandwidth)” on page 463 in the section "Common Measurement Functions 2" for a description of this function.

Trace Indicator Info

See “Trace Indicator Info” on page 469 in the section "Common Measurement Functions 2" for a description of this function.

Trigger

This key is used to set up the triggering for a measurement. See “Trigger” on page 470 in the section "Common Measurement Functions 2" for a description of this function.

View/Display

The view setup can be changed by selections from the View/Display menu, including by pressing View Preset: Basic.

Key Path	**Front-panel key**
Mode	VSA

Display

See “Display” on page 349 in the section "Common Measurement Functions" for a description of this function.

Layout

See “Layout” on page 479 in the section "Common Measurement Functions 2" for a description of this function.

Preset View

Remote Command	`:DISPlay:W11B:VIEW:PRESet BASic|EVM|POWer|DIAGnostic`
Example	DISP:W11B:VIEW:PRES BAS
Key Path	**(SCPI only)**
Mode	VSA

Preset View: Basic

This preset view consists of the following traces in a Grid 2x2 layout:

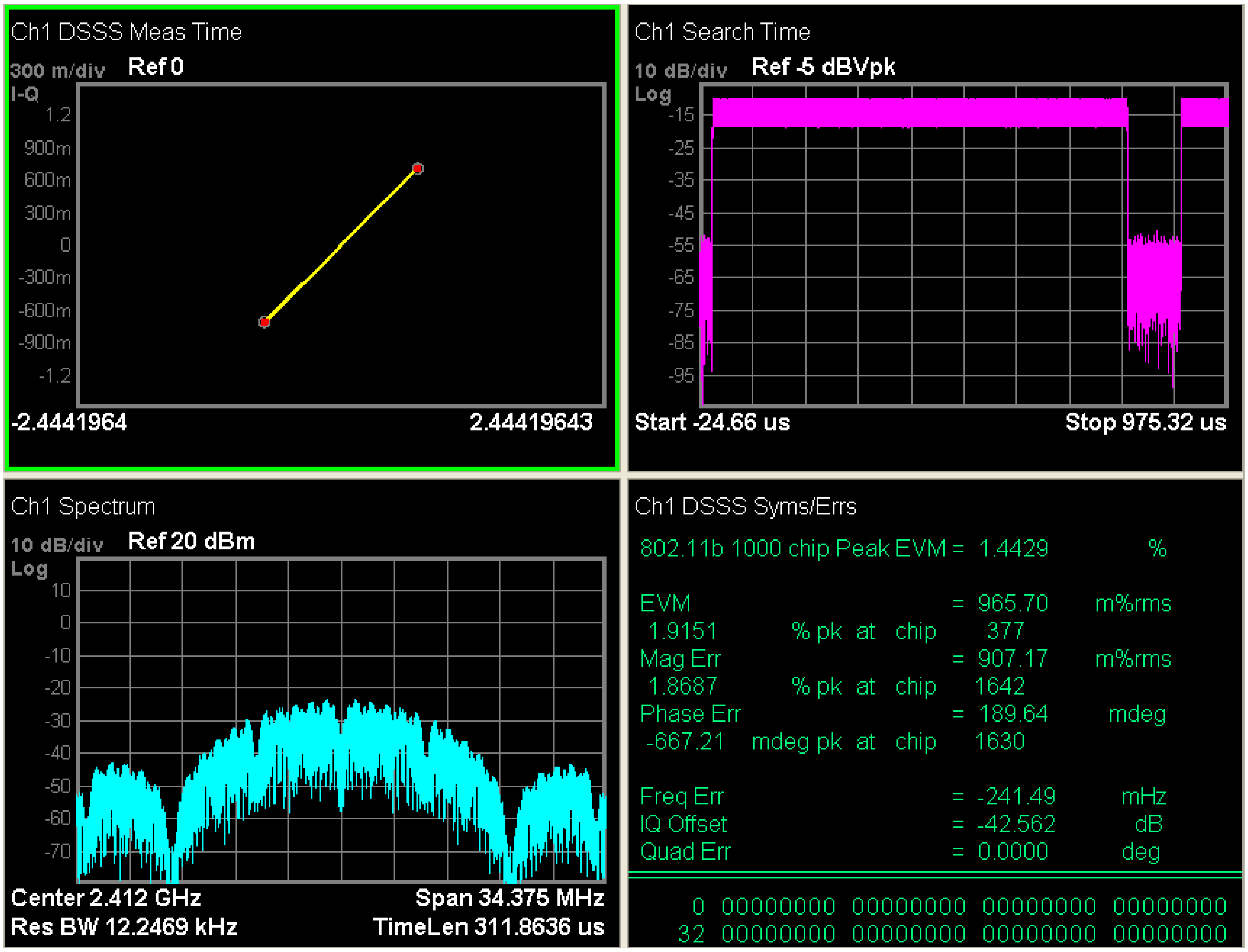
1. IQ Meas Time in I-Q format
2. Spectrum in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. Symbols/Errors

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

This layout is the layout set by Meas Preset and is good for insuring that the signal is being demodulated correctly, as well as giving visibility to many basic demodulation setup problems.

Remote Command	`:DISPlay:W11B:VIEW:PRESet BASic`
Example	DISP:W11B:VIEW:PRES BAS

Key Path	**View/Display**
Mode	VSA



Preset View: EVM

This preset view consists of the following traces in a Stacked layout:

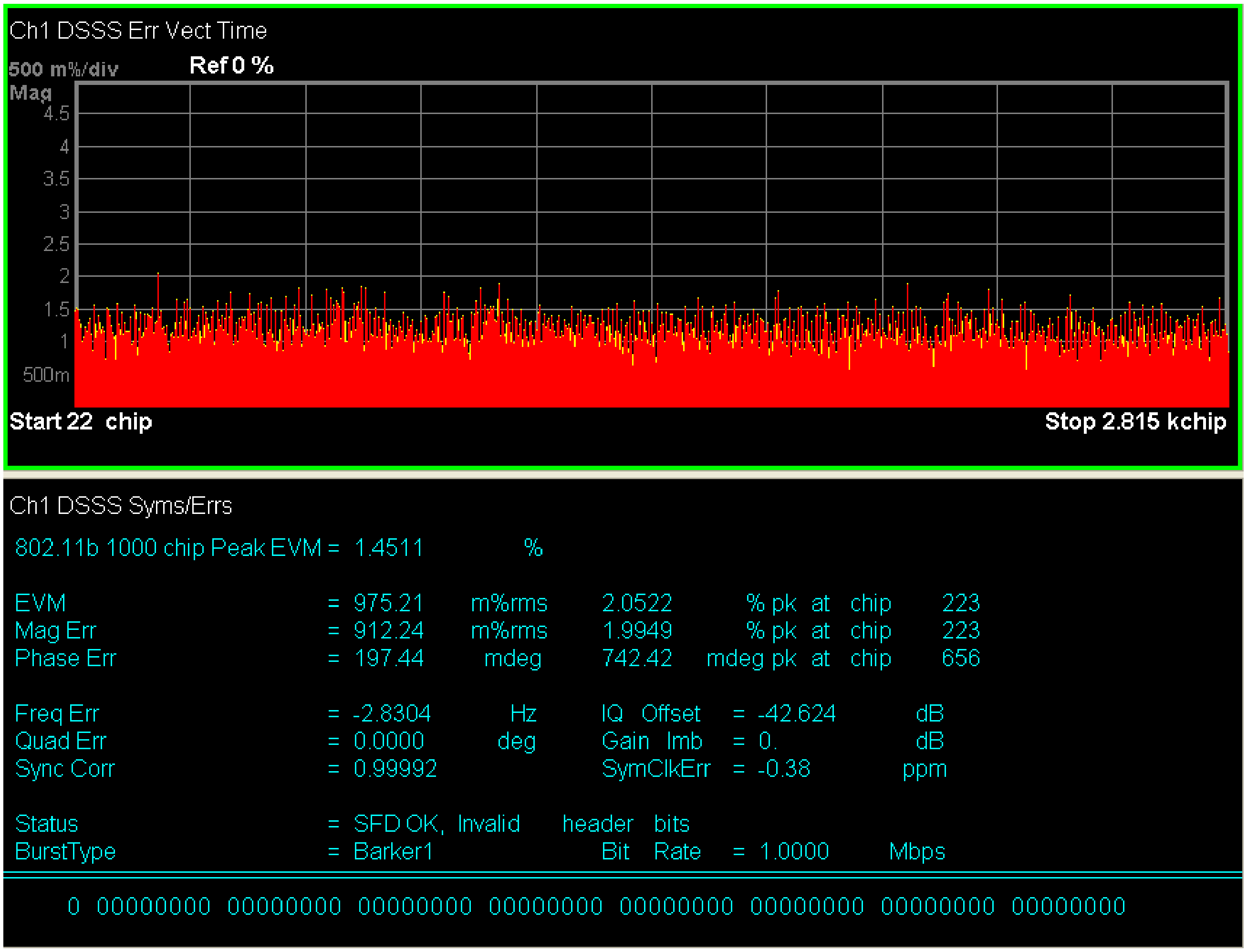
1. Error Vector Time in Linear Mag format
2. Symbols/Errors

This layout is for more detailed EVM analysis.

The Preset View: EVM softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Remote Command	`:DISPlay:W11B:VIEW:PRESet EVM`
Example	DISP:W11B:VIEW:PRES EVM
Key Path	**View/Display**

Mode	VSA



Preset View: Power

This preset view consists of the following traces in a Grid 2x2 layout:

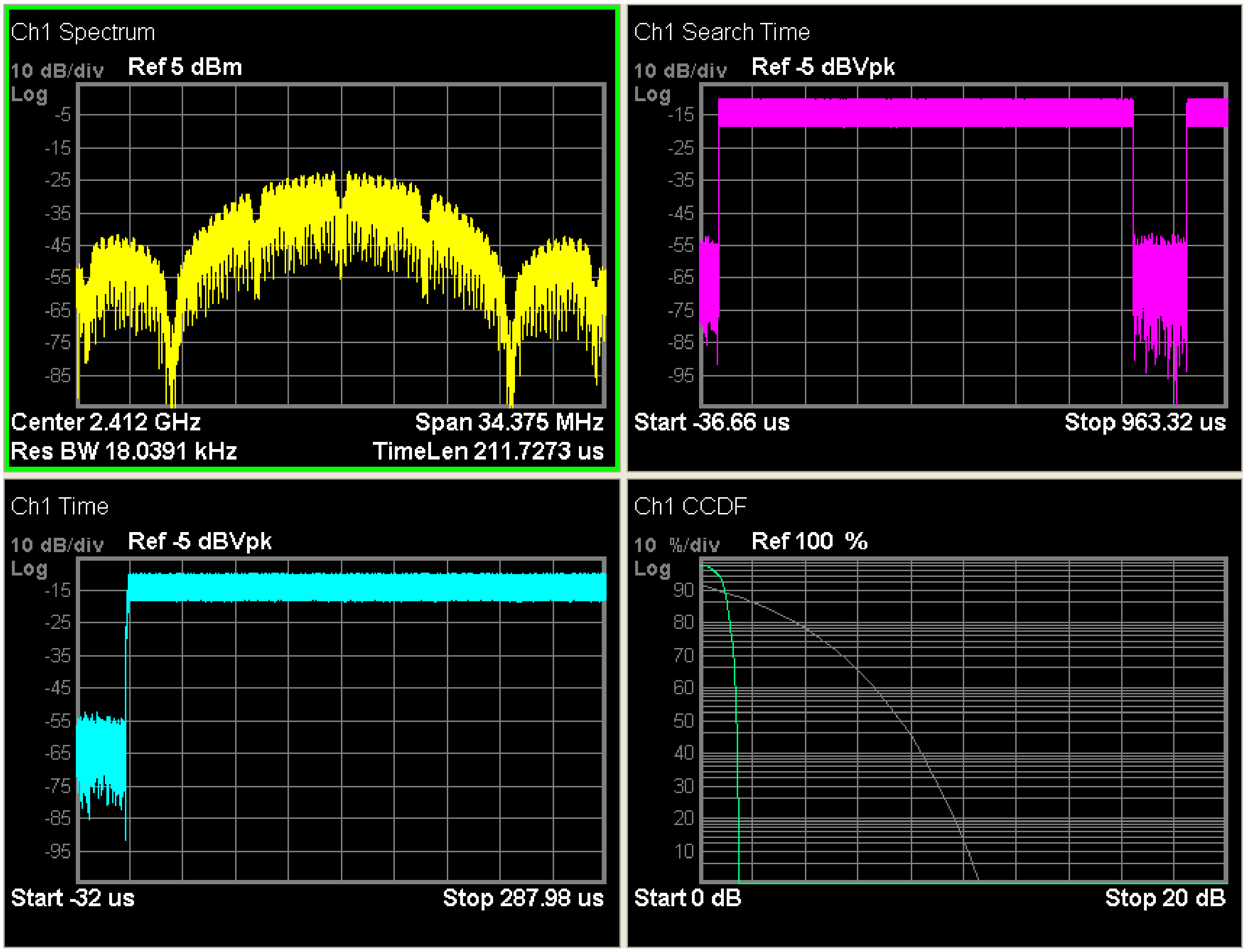
1. Spectrum in Log Mag (dB) format
2. Time in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. CCDF in Log Mag (Linear Unit) format

This layout is oriented towards examining the signal in the Time and Power domain.

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Remote Command	`:DISPlay:W11B:VIEW:PRESet POWer`
Example	DISP:W11B:VIEW:PRES POW

Key Path	**View/Display**
Mode	VSA



Preset View: Diagnostic

This preset view consists of the following traces in a Grid 2x2 layout:

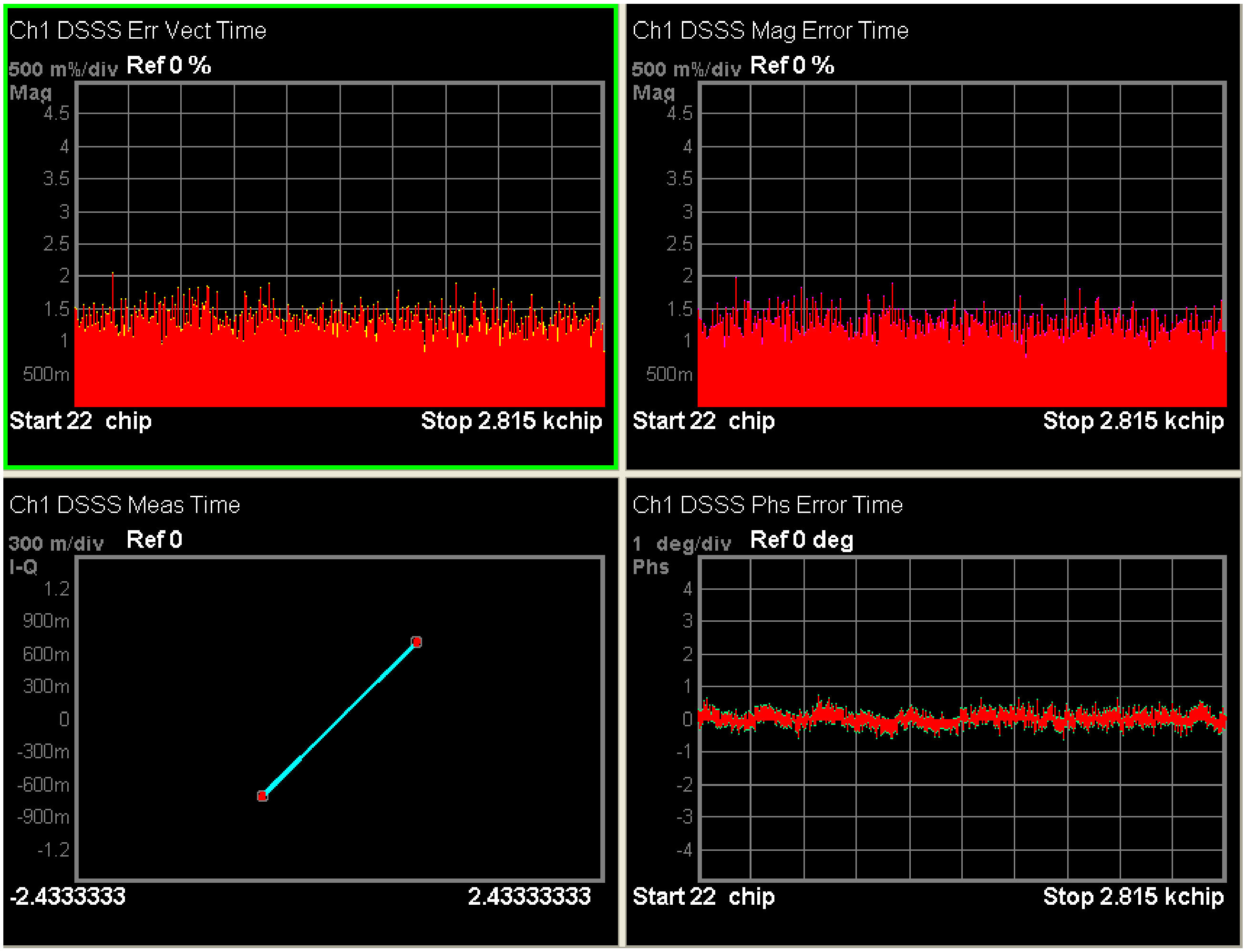
1. Error Vector Time in Linear Mag format
2. IQ Meas Time in I-Q format
3. IQ Mag Error in Linear Mag format
4. IQ Phase Error in Wrap Phase format

This layout is useful for diagnosing modulation impairments and errors.

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Remote Command	`:DISPlay:W11B:VIEW:PRESet DIAGnostic`

Example	DISP:W11B:VIEW:PRES DIAGnostic
Key Path	**View/Display**
Mode	VSA



11 WLAN OFDM

This key selects the VSA WLAN OFDM measurement.

This topic contains the following sections:

"Remote Command Results for WLAN OFDM Measurement" on page 445

"Front Panel Results" on page 446

Remote Command Results for WLAN OFDM Measurement

All of the scalar results for this measurement are contained one table and hence one equivalent subopcode for the remote results. The remote user can use this equivalence by either visually inspecting the corresponding summary trace on the display, or by using CALC:DATA queries which programmatically describe the corresponding summary trace.

`:CONFigure:W11A`

`:CONFigure:W11A:NDEFault`

`:FETCh:W11A[n]?`

`:INITiate:W11A`

`:MEASure:W11A[n]?`

`:READ:W11A[n]?`

This standard remote result is also available thru the CALC:DATA<n> set of queries, where <n> is a reference to the trace number. The results assigned to each trace vary depending on which tests are enabled. As an example, with the default trace layout, these results in the Error Summary results are returned by CALC:W11A:DATA4:TABLE? See Common Functions, Data Queries, CALCulate:DATAfor more details.

The following table denotes the VSA WLAN OFDM specific results returned from the (FETCh|MEASure|READ):W11A commands, and their corresponding CALC:DATA queries, indexed by subopcode.

Note that valid results are only returned if the Symbols/Errors trace is being computed. It must be selected though it is not necessary for it to be shown in the current Layout.

Note that there are more results available that are supported by the VSA Mode. These are documented under Common Functions, Data Queries, MEASure, READ, FETCh.

Results table (with subopcodes):

N	Results Returned
Not specified or n=1	Returns 22 comma-separated scalar results, corresponding exactly to the items returned in the Error Summary: 1. EVM (dB) 2. EVM (% rms) 3. Pilot EVM (dB) 4. CPE (%) 5. Frequency Error (Hz) 6. IQ Offset (dB) 7. IQ Quadrature Error (deg) 8. IQ Gain Imbalance (dB) 9. Sync Correlation (1.0 = ideal) 10. Symbol Clock Error (ppm) 11. Modulation Format 12. Octets (bytes) 13. Symbols 14. Code Rate (ratio) 15. Bit Rate (bps) If the results are not available, NaN (9.91e37) is returned.

In addition to these results, other results are defined in Common Functions, Data Queries, MEASure, READ, FETCh.

Modulation Format enumerations:

Enumeration	Meaning
0	Unknown
1	BPSK
2	QPSK
4	16QAM
6	64QAM

Front Panel Results

VSA WLAN OFDM results may be displayed in any trace, and the traces viewed in a variety of layouts that show 1, 2, 3, or 4 traces at a time. Each trace may be scaled as desired regardless of measurement settings, or auto-scaled to reflect measurement settings. Data may be formatted in a variety of ways. (For example, you may view the log magnitude of complex data, the real or imaginary part, etc.) You may use Preset View: Basic or other Preset Views to view frequently used results, or to provide a familiar starting point from which you may customize your own view.

Key Path	**Meas**
Mode	VSA

AMPTD Y Scale

See “AMPTD Y Scale (Amplitude)” on page 361 in the section "Common Measurement Functions 2" for for a description of this function.

Auto Couple

See “Auto Couple” on page 33 in the section "Common Measurement Functions".

BW

See “BW (Bandwidth)” on page 368 in the section "Common Measurement Functions 2" for a description of this function.

FFT Window

See “FFT Window” on page 371 in the section "Common Measurement Functions 2" for a description of this function.

Cont (Continuous)

See “Cont (Continuous Measurement/Sweep)” on page 35 in the section "Common Measurement Functions 1" for a description of this function.

FREQ Channel

See “FREQ Channel” on page 371 in the section "Common Measurement Functions 2" for a description of this function.

Input/Output

See "Input/Output" on page 43 in the section "Common Measurement Functions " for a description of this function.

Marker

See “Marker” on page 374 in the section "Common Measurement Functions 2" for a description of this function.

Marker Function

See “Marker Function” on page 392 in the section "Common Measurement Functions 2" for a description of this function.

Marker To

See “Marker -> (Marker To)” on page 390 in the section "Common Measurement Functions 2" for a description of this function.

Meas (Measure)

See “Meas” on page 155 in the section "Common Measurement Functions " for a description of this function.

Meas Setup

This key provides a menu allowing you to select measurement parameters for the current measurement.

Key Path	**Front Panel**
Mode	VSA

Avg Number

See “Avg Number” on page 400 in the section "Common Measurement Functions 2" for a description of this function.

Averaging applies to a limited set of measurement results in VSA WLAN OFDM. RMS and Max average types apply to the Spectrum and Ch Frequency Response traces. The behavior for these types is the same as in the Vector Analysis Measurement. Averaging of numeric error data in the symbol table is described below:

Average Type	**Average Mode**	**Effects of averaging**
RMS, Time	any (single sweep)	After each scan, the Syms/Err table shows a running (linear) average over past scans for each parameter in the table. Peak or position parameters are not averaged. Parameters that appear in the table in dB are converted to linear units in order to average them. The measurement stops after the specified Avg Number of scans.
RMS, Time	repeat (continuous sweep)	Same as above, except that averages are reset after the specified Avg Number of scans, and the measurement continues.
RMS, Time	exponential (continuous sweep)	Same as the single sweep case until the specified Avg Number of scans is complete. After that, averaging continues using exponential weighting.
Max	any	After each scan, compares each parameter in the table with the current scan's value and keeps the maximum. Symbol positions relate to the maximum peak value seen.

Average Mode

See “Average Mode” on page 401 in the section "Common Measurement Functions 2" for a description of this function.

Average Setup

See “Average Setup” on page 402 in the section "Common Measurement Functions 2" for a description of this function.

Demod Setup

This key brings up a menu of commonly used demodulation setup parameters.

Key Path	**Meas Setup**
Mode	VSA

Data Modulation Detect

This key allows you to select whether the data subcarrier modulation format is automatically detected or manually set to the particular modulation format selected by Modulation Format.

Remote Command	`[:SENSe]:W11A[:SUBCarrier]:DEMod:AUTO OFF|ON|0|1` `[:SENSe]:W11A[:SUBCarrier]:DEMod:AUTO?`
Coupling	Set to Default by Preset to Standard.
Example	W11A:DEM:AUTO ON
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	ON
State Saved	Saved in instrument state.
Range	Auto | Man

Modulation Format

This selects the Modulation format used when Data Modulation Detect is set to Manual.

Remote Command	`[:SENSe]:W11A[:SUBCarrier]:DEMod BPSK|QPSK|QAM16|QAM64` `[:SENSe]:W11A[:SUBCarrier]:DEMod?`
Coupling	Set to Default by Preset to Standard.
Example	W11A:DEM BPSK
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	BPSK
State Saved	Saved in instrument state.
Range	BPSK | QPSK | 16QAM | 64QAM

BPSK

Selects BPSK Data subcarrier Modulation format.

Key Path	**Meas Setup, Demod Setup, Data Modulation**
Mode	VSA

QAM

Selects QAM Data subcarrier Modulation format.

Key Path	**Meas Setup, Demod Setup, Data Modulation**
Mode	VSA

16QAM

Selects 16QAM Data subcarrier Modulation format.

Key Path	**Meas Setup, Demod Setup, Data Modulation**
Mode	VSA

64QAM

Selects 64QAM Data subcarrier Modulation format.

Key Path	**Meas Setup, Demod Setup, Data Modulation**
Mode	VSA

Guard Interval

The Guard Interval is the ratio of the Cyclic Prefix "CP" time to the inverse FFT time "T(IFFT)."

Remote Command	`[:SENSe]:W11A:GINTerval <real>` `[:SENSe]:W11A:GINTerval?`
Coupling	Set to Default by Preset to Standard.
Restriction and Notes	Entries are rounded to the nearest 1/128.
Example	W11A:GINT 0.25
Key Path	**Meas Setup, Demod Setup**
Mode	VSA
Preset	0.25
State Saved	Saved in instrument state.
Min	0.0

Max	1.0

Preset to Standard

When one of the presets from the menu below this is selected, this immediately sets all measurement parameters to the appropriate values.

When "IEEE 802.11a/g OFDM" is chosen, this is the same as Meas Preset except that the display state is left alone.

In general, this sets all parameters to their Preset values. For the " IEEE 802.11a/g Turbo Mode" and " IEEE 802.11p DSRC" presets choices, these parameters may be different: Span, Sync Training Sequence, Subcarrier Spacing, and Search Length. For all presets, Standard is set. See the descriptions of these individual parameters for details.

About IEEE 802.11g modulation:

The IEEE 802.11g standard defines both single-carrier and OFDM modulation formats. The single-carrier modulation formats are compatible with 802.11b and can be demodulated using the VSA WLAN DSSS measurement.

IEEE 802.11g defines two different OFDM modulation formats. One, which is mandatory in 802.11g, is an exact copy of the 802.11a format except that the carrier frequencies are in the 2.4 GHz band. We refer to this as "IEEE 802.11g OFDM". The other OFDM format is an optional format called DSSS-OFDM that combines an 802.11b-style single-carrier preamble with an 802.11a-style OFDM data payload. We refer to this as "IEEE 802.11g DSSS-OFDM". This measurement can demodulate and analyze either of these OFDM formats.

Remote Command	`[:SENSe]:W11A:STANdard:PRESet I11AGOFDM|HIPERLAN2|I11GDSSSOFDM|I11AGTURBO|I11PDSRC|I11J10MHZ`
Example	W11A:STAN:PRES I11AGOFDM
Key Path	**Meas Setup**
Mode	VSA
Preset	I11AGOFDM
Range	IEEE 802.11a/g OFDM | HIPERLAN/2 | IEEE 802.11g DSSS-OFDM | IEEE 802.11a/g Turbo Mode | IEEE 802.11p DSRC | IEEE 802.11j 10 MHz

This table shows the mapping between the names of the selections on the softkey menu and their corresponding SCPI forms.

Preset soft key name	**Preset SCPI form**
IEEE 802.11a/g OFDM	I11AGOFDM
HIPERLAN/2	HIPERLAN2
IEEE 802.1g DSSS-OFDM	I11GDSSSOFDM

Preset soft key name	Preset SCPI form
IEEE 802.11a/g Turbo Mode	I11AGTURBO
IEEE 802.11p DSRC	I11PDSRC
IEEE 802.11j 10 MHz	I11J10MHZ

IEEE 802.11a/g OFDM

Sets the demodulation preset to IEEE std 802.11a–1999 specification.

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

HIPERLAN/2

Sets the demodulation preset to ETSI TS 101 475 V1.2.2 (2001–02) - Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Physical (PHY) Layer specification.

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.1g DSSS-OFDM

Sets the demodulation preset to IEEE std 802.11g – 2003 specification

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.11a/g Turbo Mode

Sets the demodulation preset to a nonstandard double rate 802.11a.

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.11p DSRC

Sets the demodulation preset to ASTM E2213 – 02 DSRC specification

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.11j 10 MHz

Sets the demodulation preset to IEEE std 802.11j – 2004 specification

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

Meas Time

This key brings up a menu consisting of the time length and positioning demodulation setup parameters.

Key Path	**Meas Setup**
Mode	VSA

Search Length

Allows you to specify the length of time allowed to acquire the input signal (in seconds). This defines the length of time that the pulse search is performed.

The analyzer searches within the specified search length and demodulates the first complete pulse (burst). The pulse can occur anywhere within the search length. Pulses beyond the first complete pulse are disregarded and are not demodulated. In order for the pulse search algorithm to detect a pulse edge, the pulse must be at least 15 dB above the noise floor. The resultant pulse is then demodulated.

Remote Command	`[:SENSe]:W11A:SYNC:SLENgth <time>` `[:SENSe]:W11A:SYNC:SLENgth?`
Coupling	The minimum is constrained to meet the number of symbols of Result Length or Max Auto Result Length, whichever is active. See the table below for the Preset to Standard values.
Example	W11A:SYNC:SLEN 0.001
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	1.0 ms
State Saved	Saved in instrument state.
Min	264 us
Max	26.952 ms

The Search Length is set to the following by Preset to Standard:

Standard	**Search Length**
IEEE 802.11a/g OFDM	1.0 ms

Standard	Search Length
HIPERLAN/2	1.0 ms
IEEE 802.1g DSSS-OFDM	1.0 ms
IEEE 802.11a/g Turbo Mode	0.5 ms
IEEE 802.11p DSRC	2.0 ms
IEEE 802.11j 10 MHz	2.0 ms

Result Length

This key allows you to either manually set the Result Length or to have it automatically detected.

The result length is the total number of symbols included in the acquired and demodulated data. The Measurement Interval and Measurement Offset parameters are used to specify the measurement length within the Result Length.

When Result Length is Automatic, the result length is the number of symbols in the current burst, up to the limit of Max Auto Result Length.

Note that when Result Length is Manual, the demodulation is not limited to the number of symbols transmitted within the burst as is done when the Result Length is Auto. The analyzer will demodulate the total number of symbols specified by Result Length, which if longer than the burst, could lead to unexpected and incorrect data results.

Remote Command	`[:SENSe]:W11A:TIME:RESult:LENGth <integer>`
	`[:SENSe]:W11A:TIME:RESult:LENGth?`
	`[:SENSe]:W11A:TIME:RESult:AUTO OFF|ON|0|1`
	`[:SENSe]:W11A:TIME:RESult:AUTO?`

Coupling	Search Length is increased to include the Result Length, if Result Length is in Manual mode. Set to Preset by Preset to Standard.
Example	W11A:TIME:RES:LENG 60 W11A:TIME:RES:AUTO ON
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	60 symbols ON
State Saved	Saved in instrument state.
Min	1 symbol
Max	1367 symbols

Max Auto Result Length

When Result Length is set to Auto this key causes the effective result length, the total number of symbols included in the demodulated data, to be automatically determined by comparing the input signal's length to the Max Auto Result Length value and using the smaller number.

Remote Command	`[:SENSe]:W11A:TIME:RESult:MAX <integer>` `[:SENSe]:W11A:TIME:RESult:MAX ?`
Coupling	Search Length is increased to include the Max Auto Result Length, if Result Length is in Auto mode. Set to Default by Preset to Standard.
Example	W11A:TIME:RESult:MAX 60
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	60 symbols
State Saved	Saved in instrument state.
Min	1 symbol
Max	1367 symbols

Meas Offset

Measurement Offset determines the start position, in symbols, of the Meas Interval with respect to the first symbol of the PLCP Preamble. The value must be less than the Result Length or Maximum Result Length parameter (depending on which option is selected for Result Length). This parameter combined with Measurement Interval specifies the portion of the result length to analyze and display to the user.

Remote Command	`[:SENSe]:W11A:TIME:OFFSet <integer>` `[:SENSe]:W11A:TIME:OFFSet?`
Coupling	The maximum is limited to Result Length or Max Auto Result Length, whichever is active, minus Meas Interval. Set to Default by Preset to Standard.
Example	W11A:TIME:OFFS 0
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	0 symbols
State Saved	Saved in instrument state.
Min	0 symbols
Max	See coupling

Meas Interval

Measurement Interval, in conjunction with Meas Offset, lets you specify an interval (segment) of the result length data to be demodulated and analyzed. Measurement Interval is entered as an integer number of Symbol-times.

The measurement interval value must be less than or equal to the Result Length or Maximum Result Length parameter (depending on which option is selected for Result Length Select). This parameter combined with Measurement Offset specifies the portion of the result length to analyze and display to the user.

Remote Command	`[:SENSe]:W11A:TIME:INTerval <integer>` `[:SENSe]:W11A:TIME:INTerval?`
Coupling	The maximum is limited to Result Length or Max Auto Result Length, whichever is active. If necessary, Meas Offset is reduced to keep Meas Interval plus Meas Offset within Result Length or Max Result Length, whichever is active. Set to Default by Preset to Standard.
Example	W11A:TIME:INT 60
Key Path	**Meas Setup, Meas Time**
Mode	VSA
Preset	60 symbols
State Saved	Saved in instrument state.
Min	1 symbol
Max	See coupling

Subcarriers

Allows you to specify what Subcarrier data are analyzed and data results displayed.

Remote Command	`[:SENSe]:W11A:SUBCarrier:SELect ALL|PILot|SINGle` `[:SENSe]:W11A:SUBCarrier:SELect?`
Coupling	Set to Default by Preset to Standard.
Example	W11A:SUBC:SEL ALL
Key Path	**Meas Setup, More**
Mode	VSA
Preset	ALL
State Saved	Saved in instrument state.
Range	All | Pilots | Single

All

Displays data results for all subcarriers. (–26 Through 26)

Key Path	**Meas Setup, More, Subcarriers**
Mode	VSA

Pilots

Displays data results for all Pilot subcarriers. Pilots subcarriers include subcarrier –21, –7, 7, and 21.

Key Path	**Meas Setup, More, Subcarriers**
Mode	VSA

Single

Displays data results for the selected Subcarrier.

Key Path	**Meas Setup, More, Subcarriers**
Mode	VSA

Subcarrier

Selects the single subcarrier that is used when Single is chosen.

Remote Command	`[:SENSe]:W11A:SUBCarrier:NUMBer <integer>` `[:SENSe]:W11A:SUBCarrier:NUMBer?`
Coupling	Set to Default by Preset to Standard.
Restriction and Notes	Subcarrier 0 is unused and so may not be selected.
Example	W11A:SUBC:NUMB 1
Key Path	**Meas Setup, More, Subcarriers, Single**
Mode	VSA
Preset	1
State Saved	Saved in instrument state.
Min	–26
Max	26

Advanced

This key displays a menu that allows you to select lesser used demodulation parameters for the current measurement. These settings are for advanced users and do not normally require adjustment for most common measurements.

Key Path	**Meas Setup, More**
Mode	VSA

Subcarrier Spacing

Set the Subcarrier spacing.

Remote Command	`[:SENSe]:W11A:SUBCarrier:SPACing <freq>` `[:SENSe]:W11A:SUBCarrier:SPACing?`
Coupling	Span is forced to be at least 5.3 times the Subcarrier Spacing. So the maximum Span sets the maximum Subcarrier Spacing. Likewise, the Span will be forced to be within 530 times the Subcarrier Spacing and so the minimum Span sets the minimum Subcarrier Spacing. See the table below for the Preset to Standard values.
Example	W11A:SUBC:SPAC 312.5E3
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	312.5 kHz
State Saved	Saved in instrument state.
Min	See Coupling
Max	See Coupling

The Subcarrier Spacing is set to the following by Preset to Standard:

Standard	**Subcarrier Spacing**
IEEE 802.11a/g OFDM	312.5 kHz
HIPERLAN/2	312.5 kHz
IEEE 802.1g DSSS-OFDM	312.5 kHz
IEEE 802.11a/g Turbo Mode	625 kHz
IEEE 802.11p DSRC	156.25 kHz
IEEE 802.11j 10 MHz	156.25 kHz

Symbol Timing Adjust

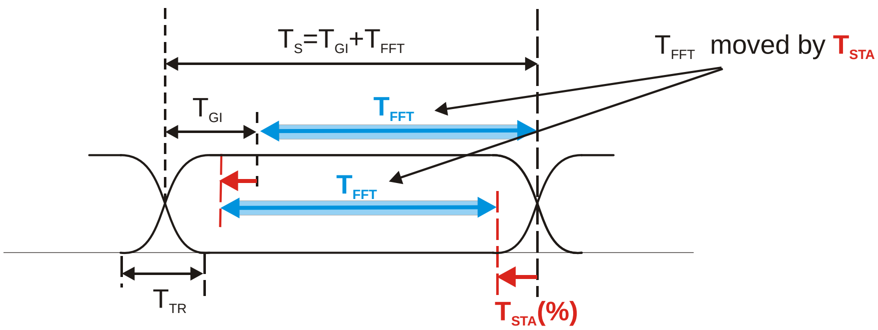
Shifts the start of the TFFT period earlier in the symbol. You specify the amount of TFFT shift as a percentage of the TFFT length.

Moving the TFFT period away from the ending transition time (TTR) into the guard interval (TGI) may help avoid inter-symbol interference. Make sure that the TFFT period is not shifted so much that it includes corrupt data from the transition time at the beginning of the symbol.

Symbol Timing Adjust allows you to adjust the "useful symbol time period" (TFFT) within the "OFDM extended symbol time period" (TS). Symbol Timing Adjust shifts the start of the TFFT period earlier in the TS time period. You specify the amount of TFFT shift as a percentage of the TFFT length.

The extended OFDM symbol time period (TS) consists of a guard interval (TGI) plus a "useful symbol time period" (TFFT). Within the TS, the analyzer performs the demodulation and data analysis on only one TFFT time period. The Symbol Time Adjust parameter allows you to move the TFFT within the TS. This value is expressed as a percentage of the TFFT length.

Typically, the TGI time period is ignored and only the TFFT time period is used. The Symbol Time Adjust parameter causes the demodulation start time to begin earlier within each extended symbol time. The minimum Symbol Time Adjust value is equal to "guard interval*100", the maximum value is "0" (full guard interval).



T_S = Extended Symbol Time
T_{GI} = Guard Interval
T_{FFT} = Useful Symbol Time Period and also the FFT Time Period
T_{TR} = Symbol Transition Time
T_{STA} = Symbol Timing Adjust (%)

OFDM Frame with cyclic extension for a single symbol time

Remote Command	`[:SENSe]:W11A:TADJust <real>` `[:SENSe]:W11A:TADJust?`
Coupling	Set to Default value for all Standards by Preset to Standard.
Example	W11A:TADJ –3.125
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	–3.125 %
State Saved	Saved in instrument state.
Min	–25 %
Max	0.0 %

Pilot Tracking

This key displays a menu of several Pilot Tracking setup parameters.

Key Path	**Meas Setup, More, Advanced**
Mode	VSA

Track Amplitude

When Track Amplitude is selected, the analyzer applies pilot subcarrier amplitude error correction to the pilot and data subcarriers. This is in addition to Track Phase and Track Timing error correction if selected.

This parameter specifies whether the analyzer tracks amplitude changes in the pilot subcarriers. When true, the Common Pilot Error trace will show the amplitude tracking in the magnitude portion of the trace

Remote Command	`[:SENSe]:W11A:TRACk:AMPLitude OFF|ON|0|1` `[:SENSe]:W11A:TRACk:AMPLitude?`
Coupling	Set to Default by Preset to Standard.
Example	W11A:TRAC:AMPL OFF
Key Path	**Meas Setup, More, Advanced, Pilot Tracking**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

Track Phase

When Track Phase is selected, the analyzer applies pilot subcarrier phase error correction to the pilot and data subcarriers. This is in addition to Track Amplitude and Track Timing error correction if selected.

Remote Command	`[:SENSe]:W11A:TRACk:PHASe OFF|ON|0|1` `[:SENSe]:W11A:TRACk:PHASe?`
Coupling	Set to Default by Preset to Standard.
Example	W11A:TRAC:PHASe ON
Key Path	**Meas Setup, More, Advanced, Pilot Tracking**
Mode	VSA
Preset	ON
State Saved	Saved in instrument state.

Track Timing

When Track Timing is selected the analyzer applies pilot subcarrier timing error correction (frequency offset correction) to the pilot and data subcarriers. This is in addition to Track Amplitude and Track Phase error correction if selected.

Remote Command	`[:SENSe]:W11A:TRACk:TIMing OFF|ON|0|1` `[:SENSe]:W11A:TRACk:TIMing?`
Coupling	Set to Default by Preset to Standard.
Example	W11A:TRAC:TIM OFF
Key Path	**Meas Setup, More, Advanced, Pilot Tracking**
Mode	VSA
Preset	OFF
State Saved	Saved in instrument state.

EQ Training

When demodulating an OFDM signal, the analyzer uses an equalizer to correct for linear impairments in the signal path, such as multi-path. The 89600 analyzer supports two different ways to initialize, or "train," the equalizer.

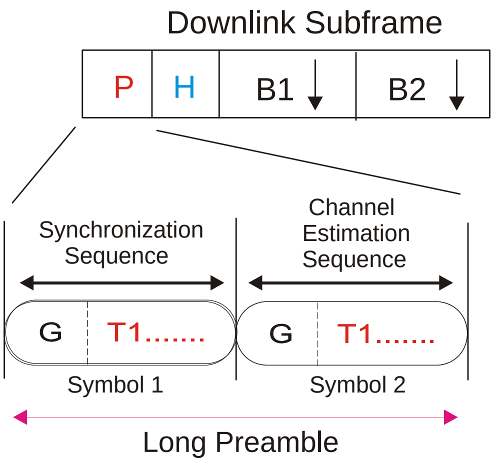
The valid values are Channel Estimation Seq Only and Channel Estimation Seq & Data. The value Channel Estimation Seq Only, which is the default, specifies that the equalizer is trained using only the channel estimation sequence (also called the "long sync") portion of the burst preamble.

The value and Channel Estimation Seq & Data specifies that the equalizer should be trained using both the channel estimation sequence and the entire data portion of the burst. This usually gives a more accurate estimate of the equalizer response. It also typically lowers the EVM by one or two dB.

Remote Command	`[:SENSe]:W11A:EQUalizer:TRAining CHANnel|CDATa` `[:SENSe]:W11A:EQUalizer:TRAining?`
Coupling	Set to Default by Preset to Standard.
Example	W11A:EQU:TRA CHAN
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	Channel Est Seq Only
Range	Channel Est Seq Only | Channel Est Seq & Data

Channel Est Seq Only

The equalizer is trained by looking at the Channel Estimation Sequence in the preamble of the OFDM burst. After this initialization, the equalizer coefficients are held constant while demodulating the rest of the burst.



Key Path	**Meas Setup, More, Advanced, EQ Training**
Mode	VSA

Channel Est Seq & Data

The equalizer is trained by analyzing the entire OFDM burst, including the Channel Estimation Sequence (contained in the preamble) and the Data symbols. This type of training generally gives a more accurate estimate of the true response of the transmission channel.

Key Path	**Meas Setup, More, Advanced, EQ Training**
Mode	VSA

Sync Training Sequence

The Sync parameters control the type of synchronization used to synchronize to the start of an OFDM burst. The two available choices are "Short Training Sequence" (also called Short Sync or Short Training Symbols) and "Chan Estimation Seq" (also called Long Sync or Long Training Symbols).

Remote Command	`[:SENSe]:W11A:SYNC:SEQuence LONG|SHORt` `[:SENSe]:W11A:SYNC:SEQuence?`
Coupling	See the table below for the Preset to Standard values.
Example	W11A:SYNC:SEQ SHOR
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	SHOR
Range	Long | Short

The Sync Training Seq is set to the following by Preset to Standard:

Standard	Sync Training Seq
IEEE 802.11a/g OFDM	Short
HIPERLAN/2	Long (Channel Estimation)
IEEE 802.1g DSSS-OFDM	Long (Channel Estimation)
IEEE 802.11a/g Turbo Mode	Long (Channel Estimation)
IEEE 802.11p DSRC	Short
IEEE 802.11j 10 MHz	Short

IQ Normalize

When set to On, the IQ trace data results (including IQ Meas, IQ Ref, Error Vector Time and corresponding Spectrum results) are normalized.

When set to Off, the trace data results are not normalized.

When normalization is On, the analyzer normalizes or scales the demodulated trace data results, in magnitude, to a nominal value of 1, relative to the outermost states of the ideal (IQ Reference) constellation diagram.

Note that regardless of this setting, the Error Summary trace data results are always normalized.

Remote Command	`:CALCulate:W11A:NORMalize OFF|ON|0|1` `:CALCulate:W11A:NORMalize?`
Coupling	Set to Default by Preset to Standard.
Example	CALC:W11A:NORM ON
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	ON
State Saved	Saved in instrument state.

Standard

This single parameter takes care of setting a number of internal, standard specific details of the demodulation. The valid values are the same as that of Preset to Standard and are set to the same by Preset to Standard.

Remote Command	`[:SENSe]:W11A:STANdard I11AGOFDM | HIPERLAN2 | I11GDSSSOFDM | I11AGTURBO | I11PDSRC | I11J10MHZ` `[:SENSe]:W11A:STANdard?`
Coupling	Set to matching Standard by Preset to Standard.

Example	W11A:STAN I11J10MHZ
Key Path	**Meas Setup, More, Advanced**
Mode	VSA
Preset	IEEE 802.11a/g OFDM
Range	IEEE 802.11a/g OFDM | HIPERLAN/2 | IEEE 802.1g DSSS-OFDM | IEEE 802.11a/g Turbo Mode | IEEE 802.11p DSRC | IEEE 802.11j 10 MHz

This table shows the mapping between the names of the selections on the softkey menu and their corresponding SCPI forms.

Preset soft key name	Preset SCPI form
IEEE 802.11a/g OFDM	I11AGOFDM
HIPERLAN/2	HIPERLAN2
IEEE 802.1g DSSS-OFDM	I11GDSSSOFDM
IEEE 802.11a/g Turbo Mode	I11AGTURBO
IEEE 802.11p DSRC	I11PDSRC
IEEE 802.11j 10 MHz	I11J10MHZ

IEEE 802.11a/g OFDM

Per the IEEE std 802.11a–1999 specification.

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

HIPERLAN/2

Per the ETSI TS 101 475 V1.2.2 (2001–02) - Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Physical (PHY) Layer specification.

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.1g DSSS-OFDM

Per the IEEE std 802.11g – 2003 specification

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.11a/g Turbo Mode

This is a nonstandard double rate 802.11a.

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.11p DSRC

Per the ASTM E2213 – 02 DSRC specification

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

IEEE 802.11j 10 MHz

Per the IEEE std 802.11j – 2004 specification

Key Path	**Meas Setup, Preset to Standard**
Mode	VSA

Meas Preset

This immediately sets all measurement parameters to their 802.11a/g OFDM Preset values. This presets the display state in the same way as Preset View: Basic.

For more information, see the section under the Preset key in the Utility section.

Key Path	**Meas Setup, More**
Mode	VSA

Mode

See “Mode” on page 213in the section "Common Measurement Functions" for a description of this function.

Mode Setup

See “Mode Setup” on page 229 in the section "Common Measurement Functions" for a description of this function.

Peak Search

See “Peak Search” on page 406 in the section "Common Measurement Functions 2" for a description of this function.

Recall

See “Recall” on page 139 in the section "System Functions" for a description of this function.

State

See “State” on page 139 in the section "System Functions" for a description of this function.

Data

See “Data (Import)” on page 146 in the section "System Functions" for a description of this function.

Trace

See “Import Trace Data” on page 411 in the section "Common Measurement Functions 2" for a description of this function..

Open

See “Open…” on page 150 in the section "Common Measurement Functions 2" for a description of this function.

Restart

See “Restart” on page 258 in the section "Common Measurement Functions" for a description of this function.

Save

See “Save” on page 155 in the section "System Functions" for a description of this function.

State

See “State” on page 155 in the section "System Functions" for a description of this function.

Data

See “Data (Export)” on page 162 in the section "System Functions" for a description of this function.

Trace

See “Export Trace Data” on page 413 in the section "Common Measurement Functions 2" for a description of this function.

Save As…

See “Save As . . .” on page 165 in the section "System Functions" for a description of this function.

Screen Image

See “Screen Image” on page 166 in the section "System Functions" for a description of this function.

Single

See “Single (Single Measurement/Sweep)” on page 263 in the section "Common Measurement Functions" for a description of this function.

Source

See “Source” on page 263 in the section "Common Measurement Functions" for a description of this function.

SPAN X Scale

See “SPAN X Scale” on page 416 in the section "Common Measurement Functions 2" for a description of this function.

Span

This controls the frequency span of the measurement. See “FREQ Channel” on page 371 in the section “Common Measurement Functions 2” for details on how this interacts with Start, Stop, and Center frequencies.

Coupling	Limited to be within a factor of 5.3 to 530 of the Subcarrier Spacing. When Subcarrier Spacing is changed, Span may be changed to meet this requirement. See the table below for the Preset to Standard values.
Key Path	**SPAN X Scale**
Mode	VSA
Preset	31.25 MHz (limited by hardware to 10 MHz or 25 MHz with Option B25)

The Span is set to the following by Preset to Standard:

Standard	Span
IEEE 802.11a/g OFDM	31.25 MHz
HIPERLAN/2	31.25 MHz
IEEE 802.1g DSSS-OFDM	31.25 MHz
IEEE 802.11a/g Turbo Mode	62.5 MHz
IEEE 802.11p DSRC	15.625 MHz
IEEE 802.11j 10 MHz	15.625 MHz

Full Span

See Span X Scale, “Full Span” on page 416 in the section "Common Measurement Functions 2" for a description of this function.

Select Trace

See Trace/Detector, “Select Trace” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

X Scale

See Span X Scale, “X Scale” on page 420 in the section "Common Measurement Functions 2" for a description of this function.

Freq Annotation

See Span X Scale, “Freq Annotation” on page 423 in the section "Common Measurement Functions 2" for a description of this function.

All Frequency Points

See Span X Scale, “All Frequency Points” on page 422 in the section "Common Measurement Functions 2" for a description of this function.

Copy X Scale

See Span X Scale, “Copy X Scale” on page 423 in the section "Common Measurement Functions 2" for a description of this function.

Sweep/Control

See “Sweep/Control” on page 424 in the section "Common Measurement Functions 2" for a description of this function.

Trace/Detector

This section details the trace results accessible via the data key and also via SCPI, many of which are available in other measurements as well.

See “Trace/Detector” on page 428 in the section "Common Measurement Functions" for a description of this function.

Select Trace

See “Select Trace” on page 428 in the section "Common Measurement Functions 2" for a description of this function.

Data

This key provides a menu of trace data choices for the selected trace. For the SCPI command, and other details, see Trace/Detector, “Data” on page 430.

The following are the SCPI string forms for the Data types that are specific to this measurement, in alphabetical order:

Trace data soft key name	SCPI string form
CCDF	"CCDF1"
CDF	"CDF1"
Ch Frequency Response	"Ch Frequency Response1"
Common Pilot Error	"Common Pilot Error1"
Eq Impulse Response	"Eq Impulse Response1"
Error Vector Spectrum	"Error Vector Specrum1"
Error Vector Time	"Error Vector Time1"
IQ Meas	"IQ Meas1"
IQ Ref	"IQ Ref1"
Inst Ch Frequency Response	"Inst Ch Frequency Response1"
Inst Spectrum	"Inst Spectrum1"
PDF	"PDF1"
Preamble Error	"Preamble Error1"
Preamble Freq Error	Preamble Freq Error1
RMS Error Vector Spectrum	RMS Error Vector Spectrum1
RMS Error Vector Time	RMS Error Vector Time1

Trace data soft key name	SCPI string form
Raw Main Time	"Raw Main Time1"
Search Time	"Search Time1"
Spectrum	"Spectrum1"
Symbols/Errors	"Syms/Errs1"
Time	"Time1"

Key Path	**Trace/Detector**
Mode	VSA

Pre Demod

This key accesses the Trace Data choices which show pre-demodulation results.

Key Path	**Trace/Detector, Data**
Mode	VSA

Spectrum

Averaged FFT of the Time waveform. See Trace/Detector, Data, Pre-demod, “Spectrum” on page 431 in the section "Common Measurement Functions 2" for more information.

Inst Spectrum

The FFT of the time waveform for the current measurement. “Inst” or Instantaneous refers to this result not being averaged like the Spectrum Trace Data result. See Trace/Detector, Data, Pre-demod, “Inst Spectrum” on page 433 in the section "Common Measurement Functions 2" for more information.

Search Time

The Search Length long time record acquired for the current measurement.

Key Path	**Trace/Detector, Data, Pre Demod**
Mode	VSA

Time

The time record before digital demodulation and after the pulse/burst search.

The starting point is the beginning of the burst, offset by the Meas Offset and its length is the Meas Interval.

The exception to this is that 10% more additional data on both sides is shown when the Measurement Offset is set to zero and the Measurement Interval is set the same as the Result Length in Manual Result Length mode. In automatic Result Length mode, this will occur when the Measurement Offset to zero and the Measurement Interval is set to the Max Auto Result Length, but will not go more than 10%

beyond the end of the burst.

Key Path	**Trace/Detector, Data, Pre Demod**
Mode	VSA

Raw Main Time

The raw time record acquired for the current measurement. This data is unprocessed and includes additional points acquired for settling of the filters involved in subsequent processing, such as the demodulation filtering. See Trace/Detector, Data, Pre-demod, “Raw Main Time” on page 436 in the section "Common Measurement Functions 2" for more information.

Statistical

This key accesses the Trace Data choices which show statistical results.

Key Path	**Trace/Detector, Data**
Mode	VSA

CCDF

The Complementary, Cumulative Density function (CCDF) for the selected input channel.

The analyzer plots CCDF using units of percent (%) for the y-axis and power (dB) for the x-axis. Power on the x-axis is relative to the signal average power. See Trace/Detector, Data, Statistical, “CCDF (Complementary, Cumulative Density Function)” on page 441 in the section "Common Measurement Functions 2" for more information.

CDF

The Cumulative Density Function (CDF) for the selected input channel. CDF is computed by integrating the CCDF (Probability Density Function). See Trace/Detector, Data, Statistical, “CDF (Cumulative Density Function)” on page 442 in the section "Common Measurement Functions 2" for more information.

PDF

The Probability Density Function (PDF) for the selected input channel. PDF indicates the probability that a given level has occurred. See Trace/Detector, Data, Statistical, “PDF (Probability Density Function)” on page 442 in the section "Common Measurement Functions 2" for more information.

Demod

This key accesses the Trace Data choices which show general demodulation results.

Key Path	**Trace/Detector, Data**
Mode	VSA

IQ Meas

IQ Meas is the measured IQ symbol values of the subcarriers. There is one complex value for each subcarrier for each symbol in the burst.

Normally this trace data is displayed as a constellation. The constellation display shows both data and pilot subcarriers, the pilots and data values are shown with different colors.

With most other display formats, the data is plotted vs. subcarrier, with the points for each symbol all plotted separately. This is the same kind of display as Error Vector Spectrum.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

IQ Ref

IQ Ref is the reference (ideal) IQ values of the subcarriers. There is one complex value for each subcarrier for each symbol in the burst.

Normally this trace data is displayed as a constellation. The constellation shows both data and pilot subcarrier symbols, the pilots and data values are shown with different colors.

With most other display formats, the data is plotted vs. subcarrier, with the points for each symbol all plotted separately. This is the same kind of display as Error Vector Spectrum.

Key Path	**Trace/Detector, Data, Demod**
Mode	VSA

Demod Error

This key accesses the Trace Data choices which show demodulation error related results.

Key Path	**Trace/Detector, Data**
Mode	VSA

Error Vector Time

This trace, like Error Vector Spectrum shows each of the individual signal error vectors for each subcarrier and symbol vs. Time (symbol) and frequency (subcarrier). Each error vector is the vector difference, for that subcarrier at that symbol-time, between the corresponding IQ Meas value and the IQ Ref value.

On this trace, the individual error vectors are plotted vs Time (symbol). So at each valid symbol, there is a point plotted for each valid subcarrier (52 total, since subcarrier 0 is not used.) In addition, a white trace is drawn, where each point is the RMS average over the valid subcarriers, which is the same result as is plotted separately as RMS Error Vector Time.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

RMS Error Vector Time

RMS Error Vector Time is the difference between IQ Meas and IQ Ref is the error vector (which would have a complex value) at each subcarrier at each symbol-time. This trace is the RMS average of the error vector for each valid subcarrier at the plotted symbol, the same data shown as a white trace shown in Error Vector Time.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Error Vector Spectrum

This trace, like Error Vector Time shows each of the individual signal error vectors for each subcarrier and symbol vs. Time (symbol) and frequency (subcarrier). Each error vector is the vector difference, for that subcarrier at that symbol-time, between the corresponding IQ Meas value and the IQ Ref value.

On this trace, the individual error vectors are plotted vs frequency (subcarrier). So at each valid subcarrier, there is a point plotted for each valid symbol. Note that subcarrier 0 is not plotted since it is not used. In addition, a white trace is drawn, where each point is the RMS average over the valid symbols, which is the same result as is plotted separately as RMS Error Vector Spectrum.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

RMS Error Vector Spectrum

This trace is the RMS average of the error vector for each valid symbol at the plotted subcarrier, the same data shown as a white trace shown in Error Vector Time. Note that subcarrier 0 is not plotted since it is not used.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Common Pilot Error

This trace shows the difference between the measured and ideal pilot subcarrier symbols.

At each symbol in the burst, the measured symbol values of the four pilot subcarriers are compared with the ideal values. The differences are averaged together, producing a single complex value for each symbol. Normally the phase of this trace is displayed, showing how the pilot phase changes over the burst. You can also look at the magnitude of this trace to see signal magnitude changes over the burst.

To display in frequency units, select the Group Delay Trace Format. See Analyzer Setup Functions, Trace/Detector, Format.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Preamble Error

Preamble Error shows the correlation between segments of the measured preamble signal with the ideal preamble signal. You can select the desired preamble sequence to be compared to with the EQ Training and Sync Training Sequence parameters.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Preamble Freq Error

Preamble Frequency error is the difference between the measured center frequency of the transmitted signal and the measurement center frequency. The Preamble Frequency Error trace shows the total frequency error during the preamble portion of the OFDM burst. This includes the constant frequency error as displayed in the Symbols/Errors trace in addition to any time-varying frequency error.

When Sync Training Sequence is set to Short (the default for 802.11a), Preamble Frequency Error covers both the short training sequence and the channel estimation sequence. When the Sync type parameter is set to Chan Est, Preamble Frequency Error covers only the channel estimation sequence.

Key Path	**Trace/Detector, Data, Demod Error**
Mode	VSA

Tables

This key accesses the Trace Data choices which are in tabular form, including demodulated symbols tables.

Key Path	**Trace/Detector, Data**
Mode	VSA

Symbols/Errors

This display contains an error summary in the upper part, and a listing of demodulated symbols in the lower part. The error summary consists of:

Result name	Displayed Unit	Remote Name	Remote Unit
EVM (dB)	dB	EVMdB	dB
EVM (% rms)	%rms	EVM	%rms
Pilot EVM	dB	PilotEVM	dB
Common Pilot Error	%rms	CPE	%rms
Frequency Error	Hz	FreqErr	Hz
IQ Offset	dB	IQOffset	dB
Quadrature Error	deg	IQQuadErr	deg
Gain Imbalance	dB	IQGainImb	dB
Sync Correlation		SyncCorr	(none)

Result name	Displayed Unit	Remote Name	Remote Unit
Symbol Clock Err	ppm	SymClkErr	(none)
Modulation Format		ModFmt	(none)
Octets		Octets	(none)
Symbols		Syms	symbols
Code Rate		CodeRate	(none)
Bit Rate	bps	BitRate	bps

The error summary values may be obtained using the CALC:W11A:DATA:TABL commands.

The demodulated symbols are available as the data values for this trace and so may be accessed using the :CALCulate:W11A:DATA command. See Common Functions, Data Queries, CALCulate:DATA in the VSA Mode PD for more details.

Key Path	**Trace/Detector, Data, Tables**
Mode	VSA

Response

This key accesses the Trace Data choices which show equalizer response results.

Key Path	**Trace/Detector, Data**
Mode	VSA

Ch Frequency Response

Ch Frequency Response shows the equalizer channel frequency response, which is the reciprocal of the equalizer frequency response. This is the measured equalizer frequency response for the burst, based on analyzing the preamble of the burst. It contains one complex value for each subcarrier, plus an interpolated value at the middle unused subcarrier (a total of 53 values).

This trace is averaged when Averaging is turned on.

Key Path	**Trace/Detector, Data, Response**
Mode	VSA

Inst Ch Frequency Resp

This is the instantaneous (non-averaged) Ch Frequency Response. If averaging is on, the Inst Ch Frequency Response does not show the effects of averaging.

Key Path	**Trace/Detector, Data, Response**
Mode	VSA

EQ Impulse Response

This shows the impulse response of the equalization filter. The equalizer impulse response is computed by taking the reciprocal of the channel equalizer frequency response, performing data filtering and computations that produce a result length of 4x the FFT length, and then converting to the time domain. The Eq Impulse Response is the computed channel impulse response used to compensate for signal channel response degradation.

Key Path	**Trace/Detector, Data, Response**
Mode	VSA

ACP

This brings up a selection of the ACP result traces. See Trace/Detector, Data, "ACP Setup" on page 453 in the section "Common Measurement Functions 2" for more information.

OBW

This brings up a selection of the OBW result traces. See Trace/Detector, Data, "OBW Setup (Occupied Bandwidth)" on page 463 in the section "Common Measurement Functions 2" for more information.

Register

This brings up a selection of the Data Registers. See Trace/Detector, Data, "Register" on page 468 in the section "Common Measurement Functions 2" for more information.

No Data

A blank display is shown.

Format

See "Format" on page 443 in the section "Common Measurement Functions 2" for a description of this function.

Digital Demod Trace Setup

See "Digital Demod Trace Setup" on page 444 in the section "Common Measurement Functions 2" for a description of this function.

Copy to Data Register

See "Copy to Data Register" on page 450 in the section "Common Measurement Functions 2" for a description of this function.

Phase/Delay Properties

See "Phase/Delay Properties" on page 451 in the section "Common Measurement Functions 2" for a description of this function.

ACP Setup

See “ACP Setup” on page 453 in the section "Common Measurement Functions 2" for a description of this function.

OBW Setup

See “OBW Setup (Occupied Bandwidth)” on page 463 in the section "Common Measurement Functions 2" for a description of this function.

Trace Indicator Info

See “Trace Indicator Info” on page 469 in the section "Common Measurement Functions 2" for a description of this function.

Trigger

See “Trigger” on page 470 in the section "Common Measurement Functions 2" for a description of this function.

View/Display

See “View/Display” on page 479 in the section "Common Measurement Functions 2" for a description of this function.

Display

See “Display” on page 349 in the section "Common Measurement Functions" for a description of this function.

Layout

See “Layout” on page 479 in the section "Common Measurement Functions 2" for a description of this function.

Preset View

Remote Command	`:DISPlay:W11A:VIEW:PRESet BASic|EVM|POWer|DIAGnostic`
Example	DISP:W11A:VIEW:PRES BAS
Key Path	**(SCPI only)**
Mode	VSA

Preset View: Basic

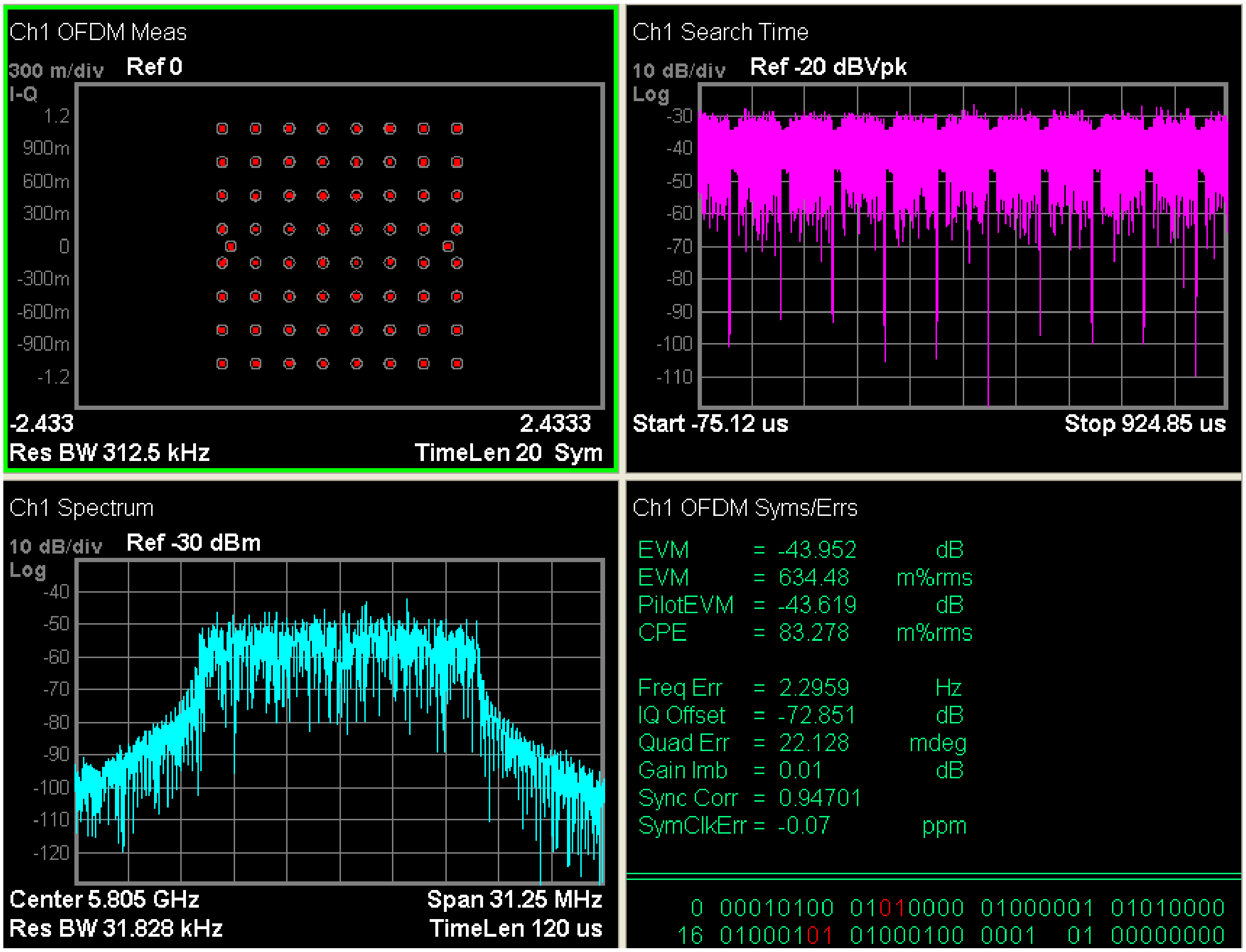
This preset view consists of the following traces in a Grid 2x2 layout:

1. IQ Meas Time in I-Q format
2. Spectrum in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. Symbols/Errors

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

This layout is the layout set by Meas Preset and is good for insuring that the signal is being demodulated correctly, as well as giving visibility to many basic demodulation setup problems.

Remote Command	`:DISPlay:W11A:VIEW:PRESet BASic`
Example	DISP:W11A:VIEW:PRES BAS
Key Path	**View/Display**
Mode	VSA



Preset View: EVM

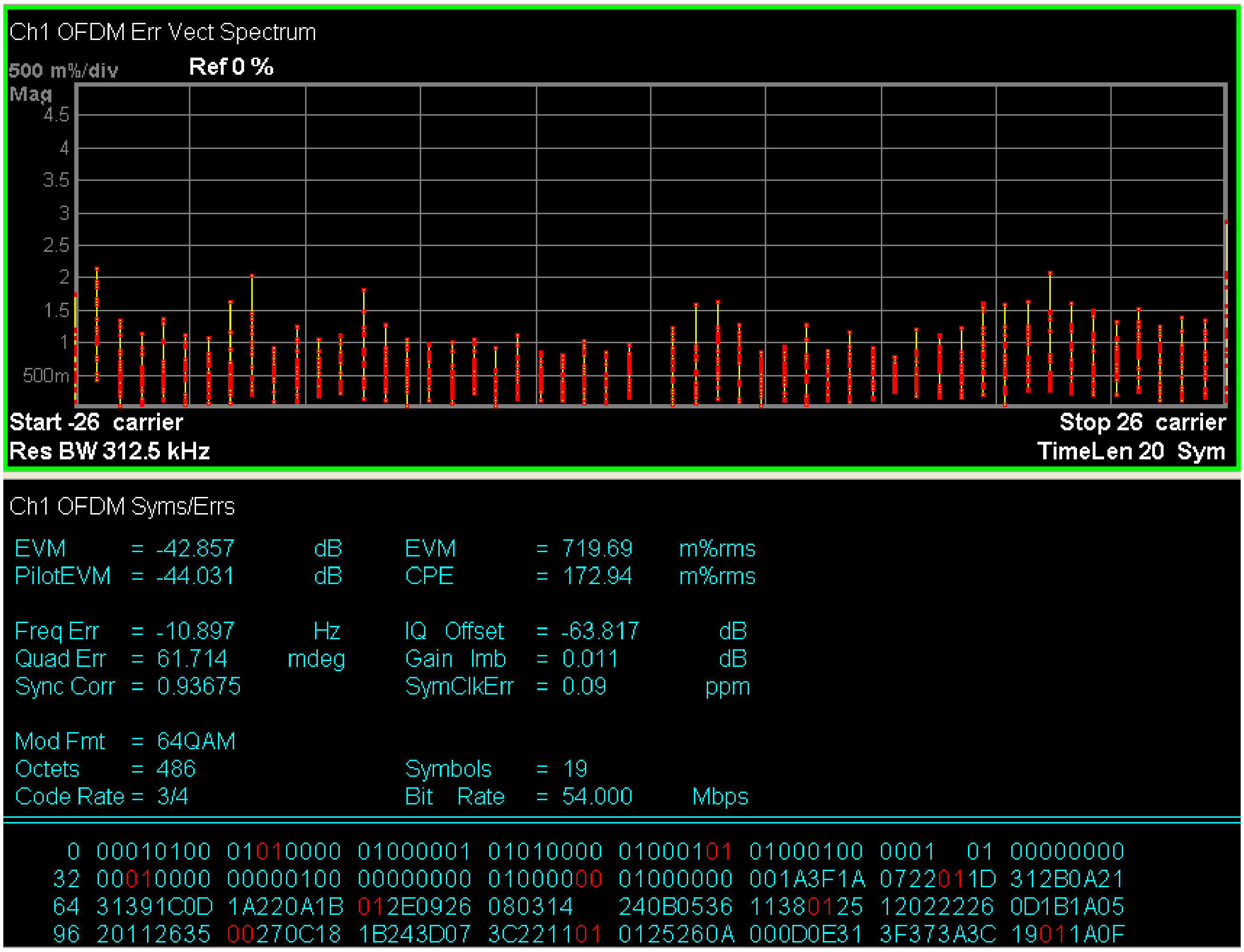
This preset view consists of the following traces in a Stacked layout:

1. Error Vector Spectrum in Linear Mag format
2. Symbols/Errors

This layout is for more detailed EVM analysis.

The Preset View: EVM softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Remote Command	`:DISPlay:W11A:VIEW:PRESet EVM`
Example	DISP:W11A:VIEW:PRES EVM
Key Path	**View/Display**
Mode	VSA



Preset View: Power

This preset view consists of the following traces in a Grid 2x2 layout:

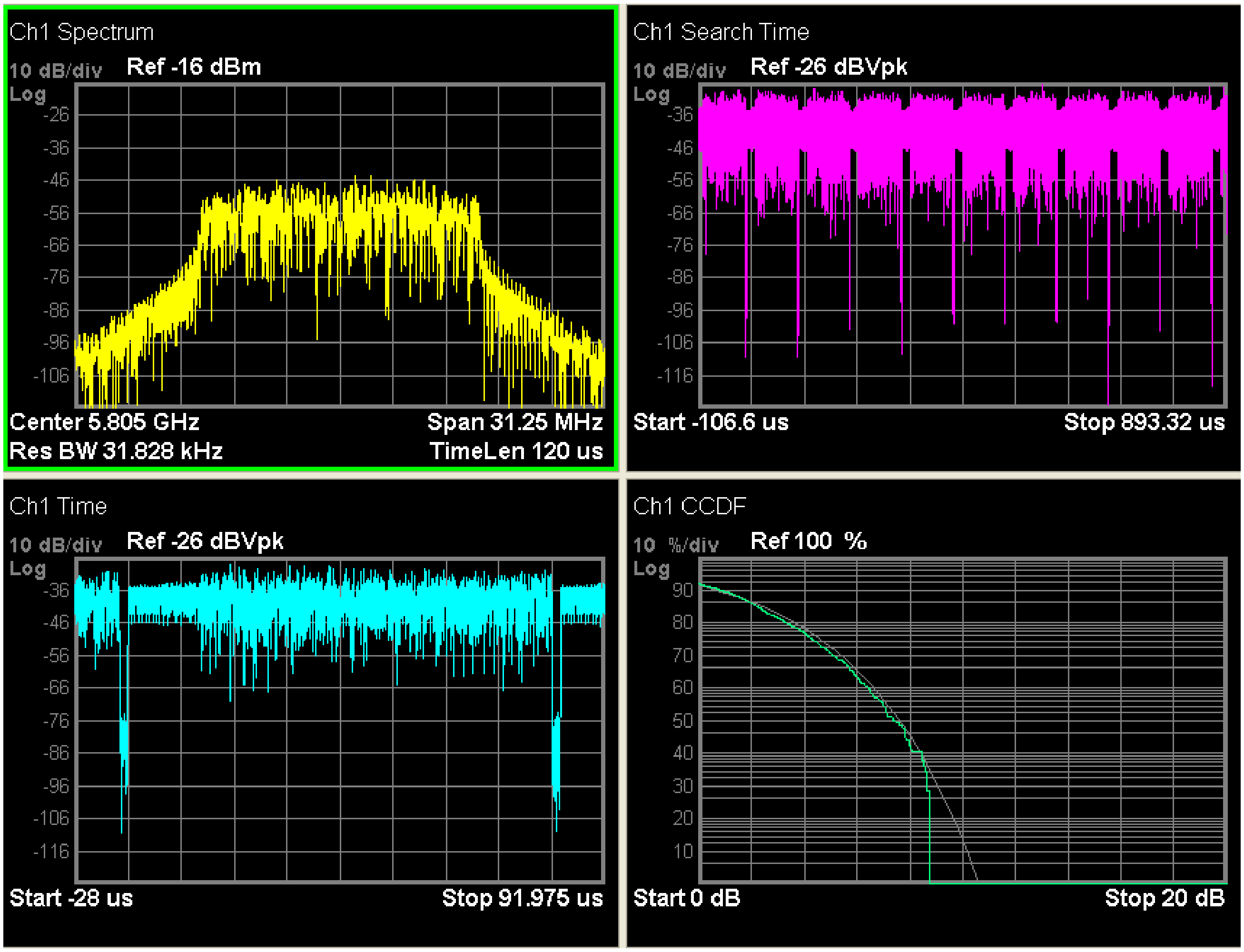
1. Spectrum in Log Mag (dB) format
2. Time in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. CCDF in Log Mag (Linear Unit) format

This layout is oriented towards examining the signal in the Time and Power domain.

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Remote Command	`:DISPlay:W11A:VIEW:PRESet POWer`
Example	DISP:W11A:VIEW:PRES POW
Key Path	**View/Display**

Mode	VSA



Preset View: Diagnostic

This preset view consists of the following traces in a Grid 2x2 layout:

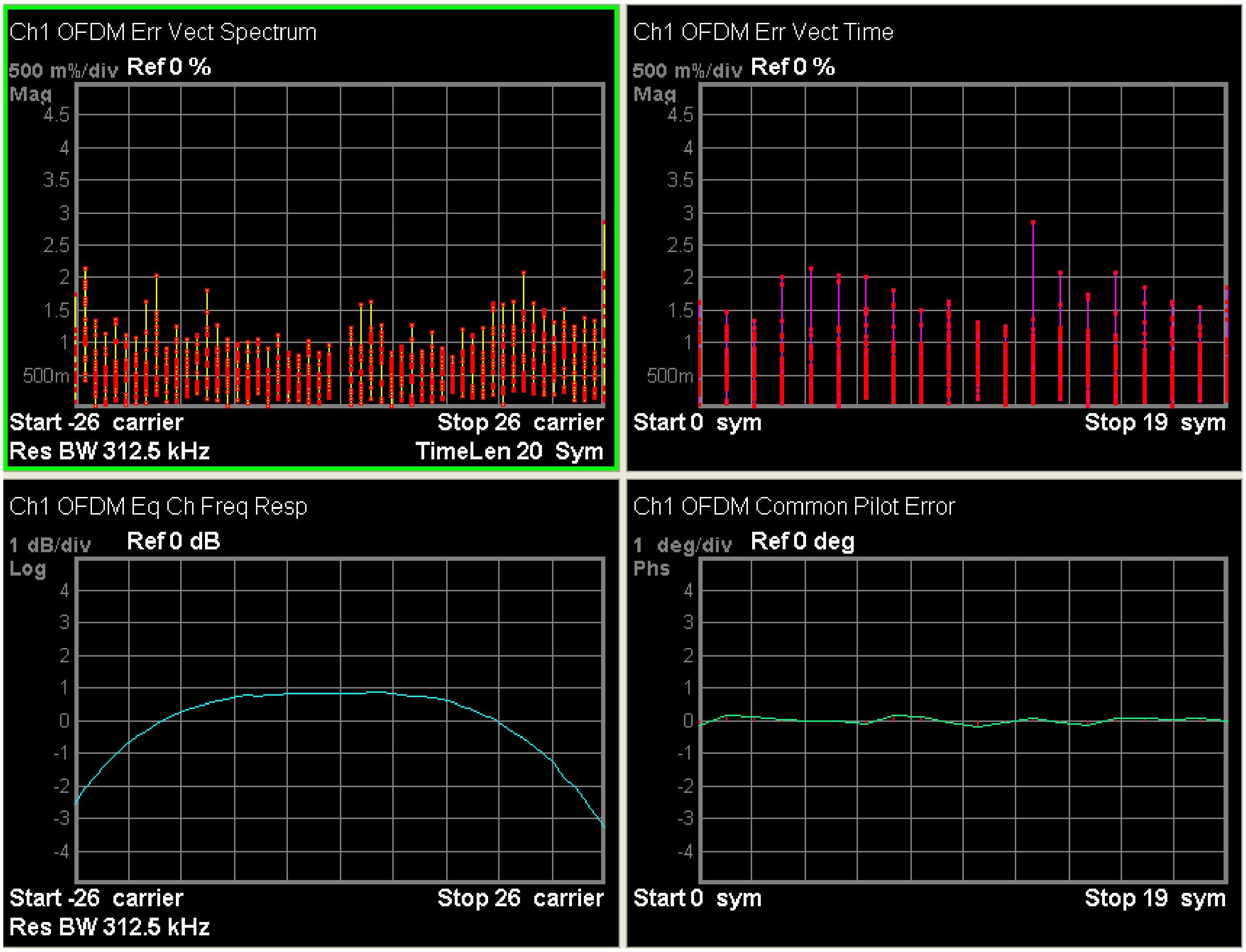
1. Error Vector Spectrum in Linear Mag format
2. Ch Frequency Response in Log Mag (dB) format
3. Error Vector Time in Linear Mag format
4. Common Pilot Error in Wrap Phase format

This layout is useful for diagnosing modulation impairments and errors.

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Remote Command	`:DISPlay:W11A:VIEW:PRESet DIAGnostic`
Example	DISP:W11A:VIEW:PRES DIAGnostic

Key Path	**View/Display**
Mode	VSA



12 Common Measurement Functions

The key and command descriptions in this section describe functions that operate the same in multiple measurements and/or modes. This section is a library of functions that is referenced by many measurements and modes

To find the exact description and parameters for functions in a specific measurement, always look in the measurement section of this documentation. Pressing the front-panel key or softkey and then pressing the green Help key also provides the correct information.

NOTE	If you want to print the documentation, be sure to select this section and the measurement of interest to ensure having all the information you need. See "Printing Acrobat Files" on page 81 for further instructions about printing.

Common Measurement Functions 1

The key and command descriptions in this section describe functions that operate identically in multiple measurements and/or modes. This section is a library of functions that is referenced by many measurements and modes.

measurement section of this documentation. Pressing the front-panel key or softkey and then pressing the green Help key also provides the correct information.

NOTE	If you want to print the documentation, be sure to select this section and the measurement of interest to ensure having all the information you need. See “Printing Acrobat Files” on page 145 for further instructions about printing.

AMPTD Y Scale

The Amplitude front-panel key activates the Amplitude menu and selects Reference Level or Reference Value (depending on the measurement) as the active function.

Some features in the Amplitude menu apply to multiple measurements; others apply only to specific measurements. Keys that only apply to some measurements are blanked or grayed out in measurements in which they are not supported.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Reference Level

The Reference Level specifies the amplitude represented by the topmost graticule line.

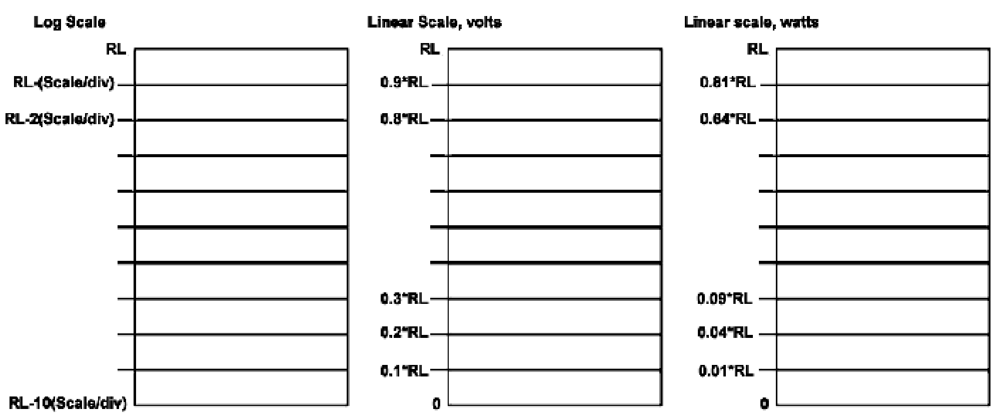
Changing the reference level does not restart a measurement, because it is a display function only; instead it vertically ‘pans’ all displayed traces and markers to the new value. If a change to the reference level changes the attenuation value (eg through an auto coupling), then the measurement will be restarted.

Key Path	**AMPTD Y Scale**
Remote Command	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	DISP:WIND:TRAC:Y:RLEV 20 dBm Sets the reference level to 20 dBm, which displays in the current Y axis unit. For example, if the Y axis unit is dBµV, then 126.99 dBµV will be displayed.

Couplings	If you reduce the attenuation, the analyzer may have to lower the reference level to keep it below its allowed maximum. This allowed maximum level is specified in the "Max" row, below, along with other variables which affect it. When you increase attenuation, the reference level does not change.
Preset	0 dBm
State Saved	Saved in instrument state
Min	RefLevelMin = –170 dBm + RefLevelOffset - ExtGain.
Max	The maximum Ref Level is typically: +30 dBm + RL Offset – External Gain (for MXA and PXA) +23 dBm + RL Offset – External Gain (for EXA and CXA) This maximum value is determined by the maximum power that can be safely applied to the input circuitry. The actual maximum value at any given time may be even less than this, depending on other values including Mech Atten, Int Preamp Gain, Swept IF Gain, FFT IF Gain, Max Mixer Level, and the total attenuation currently available.
Default Unit	Depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

Amplitude Representations

The following is an illustration of the reference level and Y Axis scales under various conditions:



Attenuation

This menu controls the attenuator functions and interactions between the attenuation system components.

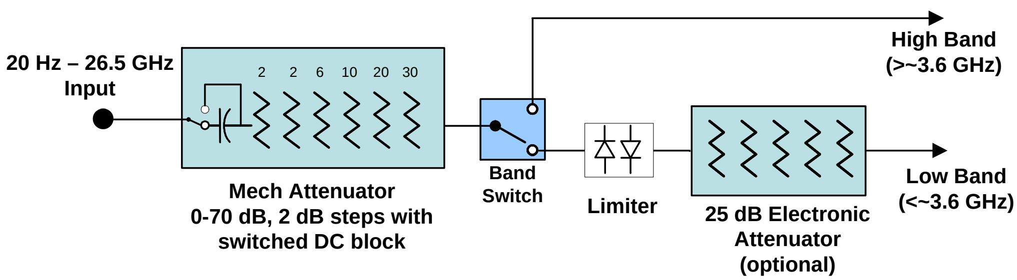
There are two attenuator configurations in the X-Series. One is a dual attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

See “Dual Attenuator Configuration:” on page 3.

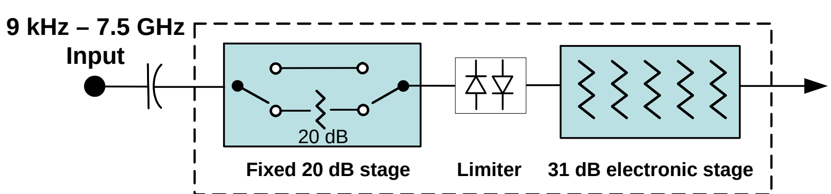
See “Single Attenuator Configuration:” on page 3.

Key Path	**AMPTD Y Scale**
Scope	Meas Global
Dependencies	In measurements which support the I/Q inputs, this key is unavailable when I/Q is the selected input, and is replaced by the Range key in that case.
Readback Line	Contains a summary in [ ] brackets of the current total attenuation. See the descriptions of the “(Mech) Atten ” on page 4, “Enable Elec Atten” on page 6, and “Elec Atten” on page 8 keys for more detail on the contributors to the total attenuation. Note that when "Pre-Adjust for Min Clip" is on, this value can change at the start of every measurement.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

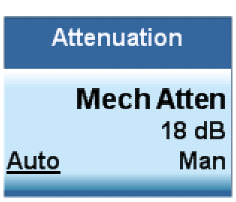
Dual Attenuator Configuration:



Single Attenuator Configuration:

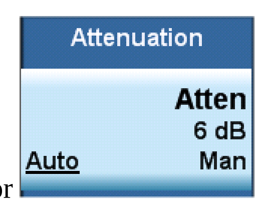


You can tell which attenuator configuration you have by pressing the Attenuation key, which (in most Modes) opens up the Attenuation menu. If the first key in the Attenuation menu says **Mech Atten** you have the dual attenuator configuration. If the first key says **Atten** you have the single attenuator configuration.



Dual Attenuator

Single Attenuator



In the single attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the dual attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the dual attenuator configuration, you may still have only a single attenuator, because unless you purchase the Electronic Attenuator option you will only have the mechanical attenuator.

Most Attenuation settings are the same for all measurements – they do not change as you change measurements.

(Mech) Atten

This key is labeled **Mech Atten** in dual attenuator models and **Atten** in single attenuator models. In the dual attenuator configuration, this key only affects the mechanical attenuator.

This key lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 5.

Key Path	**AMPTD Y Scale, Attenuation**

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF|ON|0|1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

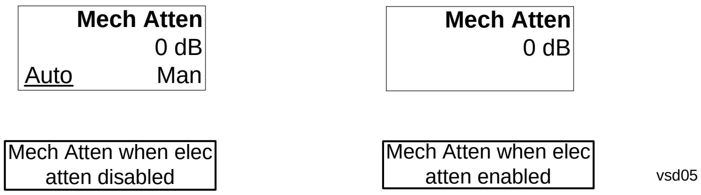
Example	POW:ATT 20 Dual attenuator configuration: sets the mechanical attenuator to 20 dB Single attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation). If the attenuator was in Auto, it sets it to Manual.
Dependencies	Some measurements do not support the Auto setting of **(Mech) Atten**. In these measurements, the Auto/Man selection is not available, and the Auto/Man line on the key disappears. In dual attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man line on the key disappears. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in the **"Enable Elec Atten" on page 6**key description. See "Attenuator Configurations and Auto/Man" on page 5 for more information on the Auto/Man functionality of Attenuation.

Couplings	When **(Mech) Atten** is in Auto, it uses the following algorithm to determine a value: Atten = ReferenceLevel + PreAmpGain + ExternalGain – RefLevelOffset - MaxMixerLevel + IF Gain. Limit this value to be between 6 dB and the Max value. No value below 6 dB can ever be chosen by Auto. The resulting value is rounded up to the largest value possible given the attenuation step setting. That is, 50.01 dB would change to 60 dB (for a 10 dB attenuation step). The "IF Gain" term in the equation above is either 0 dB or +10 dB, depending on the settings of FFT IF Gain, Swept IF Gain, max Ref Level and the Auto/Man setting of Mech Atten.
Preset	Auto
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this key cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it has to be directly entered from the keypad or via SCPI. This protects from adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased.
Max	CXA: 50 dB EXA: 60 dB MXA and PXA: 70 dB In the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Attenuator Configurations and Auto/Man

As described in the Attenuation key description, there are two distinct attenuator configurations available in the X-Series, the single attenuator and dual attenuator configurations. In dual attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In single attenuator configurations, we refer to the attenuation set using the **(Mech) Atten** key (or POW:ATT SCPI) as the "main" attenuation; and the attenuation that is set by the SCPI command POW:EATT as the "soft" attenuation (the POW:EATT command is honored even in the single attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See the **Elec Atten** key description for more on "soft" attenuation.

In the dual attenuator configuration, when the electronic attenuator is enabled, there is no Auto/Man functionality for the mechanical attenuator, and the third line of the key label (the Auto/Man line) disappears:



Enable Elec Atten

Enables the Electronic Attenuator in dual attenuator configurations. This key does not appear in single attenuator configurations, as in the single attenuator configuration there is no "electronic attenuator" there is only a single integrated attenuator (which has both a mechanical and electronic stage).

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 8 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the single attenuator configuration, for SCPI backwards compatibility, the "soft" attenuation feature replaces the dual attenuator configuration's electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 5

See "More Information" on page 7

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF|ON|0|1` `[:SENSe]:POWer[:RF]:EATTenuation:STATe?`
Example	POW:EATT:STAT ON
Initial S/W Revision	Prior to A.02.00
Key Path	**AMPTD Y Scale, Attenuation**
Dependencies	This key only appears in the dual attenuator configuration. However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in "Attenuator Configurations and Auto/Man" on page 5 The electronic attenuator (and the "soft" attenuation function provided in single attenuator configurations) is unavailable above 3.6 GHz. Therefore, if the Stop Frequency of the analyzer is > 3.6 GHz then the **Enable Elec Atten** key will be OFF and grayed out. If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the "soft" attenuation function provided in single attenuator configurations) is unavailable. In this case the **Enable Elec Atten** key will be OFF and grayed out. If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent. If the electronic/soft Attenuator is enabled, then the Stop Freq of the analyzer is limited to 3.6 GHz and the Internal Preamp is unavailable.

Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in dual attenuator configurations). This is described in more detail below this table.
Preset	OFF for Swept SA measurement; ON for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Modified at S/W Revision	A.03.00

More Information

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state in which it has no Auto function. Here are the rules for transitioning the Mechanical Attenuator:

When the Electronic Attenuation is enabled:

- In the dual attenuator configuration, the Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode
- The Auto/Man state of (Mech) Atten is saved
- The Auto/Man line on the (Mech) Atten key disappears and the auto rules are disabled
- In the dual attenuator configuration, the Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation.

Examples in the dual attenuator configuration:

- Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled.
- Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled.
- Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled.

When the Electronic Attenuation is disabled:

- In the dual attenuator configuration, the Elec Atten key is grayed out (it never displays in the single attenuator configuration)
- The Auto/Man state of (Mech) Atten is restored
- If now in Auto, (Mech) Atten recouples
- If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB.)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The "finer steps" advantage of the electronic attenuator is beneficial in optimizing the alignment of the analyzer dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its "Auto" setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the analyzer calibration

Elec Atten

Controls the Electronic Attenuator in dual attenuator configurations. This key does not appear in single attenuator configurations, as the control of both the mechanical and electronic stages of the single attenuator is integrated into the single **Atten** key.

Key Path	**AMPTD Y Scale, Attenuation**
Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:EATTenuation?`
Notes	Electronic Attenuation's spec is defined only when Mechanical Attenuation is 6 dB.
Dependencies	This key only appears in the dual attenuator configuration. However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in **"Attenuator Configurations and Auto/Man" on page 5**. The "soft" attenuation is treated as an addition to the "main" attenuation value set by the Atten softkey or the POW:ATT SCPI command and affects the total attenuation displayed on the Attenuation key and the Meas Bar. When **Enable Elec Atten** is off, the **Elec Atten** key is grayed out.
Preset	0 dB
State Saved	Saved in instrument state
Min	0 dB

Max	Dual attenuator configuration: 24 dB Single attenuator configuration: the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Adjust Atten for Min Clip

Sets the combination of mechanical and electronic attenuation based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key is grayed out in measurements that do not support this functionality. The spectrum analyzer measurement, Swept SA, does not support this functionality.

Key Path	**AMPTD Y Scale, Attenuation**
Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Pre-Adjust for Min Clip

If this function is on, it does the adjustment described under "Adjust Atten for Min Clip" on page 9 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In dual attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

This key is grayed out in measurements that do not support this functionality. The spectrum analyzer measurement, Swept SA, does not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF|ELECtrical|COMBined`
	
	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`

Initial S/W Revision	Prior to A.02.00
Key Path	**AMPTD Y Scale, Attenuation**
Notes	The SCPI parameter ELECtrical sets this function to On in single attenuator models. The SCPI parameter COMBined is mapped to ELECtrical in single attenuator models; if you send COMBined, it sets the function to On and returns ELEC to a query.

Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clip**
State Saved	Saved in instrument state
Range	Dual attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single attenuator models: Off | On
Modified at S/W Revision	A.03.00

Remote Command:	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON|OFF|1|0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`
Notes:	ON aliases to "Elec Atten Only" OFF aliases to "Off" The query returns true if not "Off"
Initial S/W Revision:	Prior to A.02.00

(Mech) Atten Step

This controls thestep size used when making adjustments to the input attenuation.

This key is labeled **Mech Atten Step** in dual attenuator models and **Atten Step** in single attenuator models. In the dual attenuator configuration, this key only affects the step size of the mechanical attenuator.

Key Path	**AMPTD Y Scale, Attenuation**
Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB	2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	POW:ATT:STEP 2
Notes	Note this feature works like a 1-N choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10.
Dependencies	Blanked in CXA and EXA if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI will yield an "Option not present" error.
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	PXA and MXA: 2 dB EXA and CXA: 10 dB (2 dB with option FSA)
State Saved	Saved in instrument state

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Max Mixer Level

Controls the limitation on the Ref Level for a given attenuation setting, and therefore also interacts with the Auto rules for selecting the attenuation as a coupling from the reference level.

Key Path	**AMPTD Y Scale, Attenuation**
Remote Command	`[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real>` `[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?`
Example	POW:MIX:RANG –15 dBm
Preset	–10 dBm
State Saved	Saved in instrument state
Min	–50 dBm
Max	–10 dBm
Default Unit	Depends on the current selected Y axis unit, see Swept SA discussion of Y Axis Unit
Initial S/W Revision	Prior to A.02.00

Range

This key is only available when I/Q is the selected input. It replaces the Attenuation key in that case.

Each input channel (I and Q) has four internal gain ranges. The maximum allowed voltage in each gain range is slightly more than the nominal value, so the break point between ranges is a couple of millivolts higher than the nominal (setting a peak voltage of 0.502 mV will still map to the 0.5 V Peak range).

Gain Setting	Volts RMS	Volts Peak	Volts Peak - Peak	dBm (50Ω)	Break Point
0 dB	0.7071	1.0	2.0	10	n/a
6 dB	0.3536	0.5	1.0	4	0.502 V Peak
12 dB	0.1768	0.25	0.5	–2	0.252 V Peak
18 dB	0.0884	0.125	0.25	–8	0.127 V Peak

Key Path	**AMPTD Y Scale**
Notes	Visible only when the selected input is I/Q.
State Saved	No

Readback Text	When Range is Auto, "[Auto]" When Range is Man and I & Q are the same, "[<range value>]" When Range is Man and I & Q are different: "[I: <I range value> Q: <Q range value>]" See I Range and Q Range for the <range value> enumeration definition.
Initial S/W Revision	Prior to A.02.00

Range Auto/Man

The Auto setting for Range causes the range to be set based on the Y Scale settings. When Range is “Auto”, the I & Q Range are set based on the top of the Y Scale when the Y scale is in dB units (for example, power), or to the max(abs(top), abs(bottom)) when the Y scale reference is not at the top of the screen.

Not all measurements support Range Auto/Man. If Auto is not supported in the current measurement, this key is grayed out and shows “Man” and MAN is returned to a SCPI query; but this does NOT change the Auto/Man setting for Range.When you go to a measurement that supports Auto, it goes back to Auto if it was previously in Auto mode.

Key Path	**AMPTD Y Scale, Range**
Scope	Meas Global
Remote Command	`[:SENSe]:VOLTage:IQ:RANGe:AUTO OFF|ON|0|1` `[:SENSe]:VOLTage:IQ:RANGe:AUTO?`
Example	Put the I Range and Q Range in manual. VOLT:IQ:RANG:AUTO OFF
Dependencies	If Auto is not supported, sending the SCPI command will generate an error.
Couplings	When in Auto, both I Range and Q Range are set to the same value, computed as follows: Maximum absolute value is computed for the Y Scale. The top and bottom of the graph are computed based on Ref Value, Scale/Div, and Ref Position. Formula: YMax = max(abs(top), abs(bottom)). The I Range and Q Range are then set to YMax.
Preset	ON
State Saved	Saved in instrument state
Range	Auto | Man
Initial S/W Revision	Prior to A.02.00

Remote Command:	`[:SENSe]:POWer:IQ:RANGe:AUTO OFF|ON|0|1` `[:SENSe]:POWer:IQ:RANGe:AUTO?`

Example:	Put the I Range and Q Range in manual. POW:IQ:RANG:AUTO OFF
Notes:	The POW:IQ:RANG:AUTO is an alternate form of the VOLT:IQ:RANG:AUTO command. This is to maintain consistency with I Range and Q Range, which support both the POWer and VOLTage forms of the command.
Preset:	ON
Range:	Auto | Man
Initial S/W Revision:	Prior to A.02.00

I Range

This is the internal gain range for the I channel when Input Path is I Only or Ind I/Q, and it is used for both the I and Q channels when the Input Path is I+jQ. See “I/Q Gain Ranges” on page 16.

Key Path	**AMPTD Y Scale, Range**
Remote Command	`[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer]?`
Example	Set the I Range to 0.5 V Peak VOLT:IQ:RANG 0.5 V
Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V.
Couplings	When Q Same as I is On, the I Range value will be copied to the Q Range. Changing the value will also set Range = Man.
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak | 0.5 V Peak | 0.25 V Peak | 0.125 V Peak
Initial S/W Revision	Prior to A.02.00

Remote Command:	`[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer] <ampl>` `[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer]?`
Example:	Set the I Range to 0.5 V Peak when Reference Z is 50Ω, and to 1.0 V Peak when Reference Z is 75Ω. POW:IQ:RANG 4 dBm

Notes:	The POWer form of the command is provided for convenience. It maps to the same underlying gain range parameter as the VOLTage form of the command. The Reference Z (not the I channel Input Z) is used to convert the power to peak voltage, which is then used to set the I Range as with the VOLTage form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50Ω: 10, 4, –2, –8 75Ω: 8.2, 2.2, –3.8, –9.8 600Ω: –0.8, –6.8, –12.8, –18.9
Preset:	10.0 dBm
Range:	–20 dBm to 10 dBm
Min:	–20 dBm
Max:	10 dBm
Initial S/W Revision:	Prior to A.02.00

Q Range

Accesses the Q Range menu.

Key Path	**AMPTD Y Scale, Range**
Readback Text	Q Same as I | 1 V Peak | 0.5 V Peak | 0.25 V Peak | 0.125 V Peak When Q Same as I is On, the readback is "Q Same as I", otherwise it is the Q Range value.
Initial S/W Revision	Prior to A.02.00

Q Same as I

Many, but not all, usages require the I and Q channels to have an identical setup. To simplify channel setup, the Q Same as I will cause the Q channel range to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time Q Same as I is Off, the I and Q channel setups will be identical.

Key Path	**AMPTD Y Scale, Range, Q Range**
Remote Command	`[:SENSe]:VOLTage|POWer:IQ:MIRRored OFF|ON|0|1` `[:SENSe]:VOLTage|POWer:IQ:MIRRored?`
Example	Turn off the mirroring of I Range to Q Range. VOLT:IQ:MIRR OFF POW:IQ:MIRR OFF
Couplings	When On, the I Range value is mirrored (copied) to the Q Range.
Preset	On

State Saved	Saved in instrument state.
Range	On | Off
Readback Text	"Q Same as I" when On, otherwise none.
Initial S/W Revision	Prior to A.02.00

Q Range Value

This is the internal gain range for the Q channel. See “I/Q Gain Ranges” on page 16. The Q Range only applies to Input Path Q Only and Ind I/Q. For input I+jQ the I Range determines both I and Q channel range settings.

Key Path	**AMPTD Y Scale, Range**
Remote Command	`[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer]?`
Example	Set the Q Range to 0.5 V Peak VOLT:IQ:Q:RANG 0.5 V
Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V. The Q Range is only used for Input Path Q Only and Ind I/Q. For input I+jQ the I Range determines both I and Q channel range settings.
Couplings	When Q Same as I is On, the I Range value will be copied to the Q Range and the range value keys are disabled. Changing the value will also set Range = Man.
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak | 0.5 V Peak | 0.25 V Peak | 0.125 V Peak
Initial S/W Revision	Prior to A.02.00

Remote Command:	`[:SENSe]:POWer:IQ:Q:RANGe[:UPPer] <ampl>` `[:SENSe]:POWer:IQ:Q:RANGe[:UPPer]?`
Example:	Will set the Q Range to 0.5 V Peak when Reference Z is 50Ω, and to 1.0 V Peak when Reference Z is 75Ω. POW:IQ:Q:RANG 4 dBm

Notes:	The POWer form of the command is provided for convenience. It maps to the same underlying gain range parameter as the VOLTage form of the command. The Reference Z (not the Q channel Input Z) is used to convert the power to peak voltage, which is then used to set the Q Range as with the VOLTage form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50Ω: 10, 4, –2, –8 75Ω: 8.2, 2.2, –3.8, –9.8 600Ω: –0.8, –6.8, –12.8, –18.9
Preset:	10.0 dBm
Range:	–20 dBm to 10 dBm
Min:	–20 dBm
Max:	10 dBm
Initial S/W Revision:	Prior to A.02.00

I/Q Gain Ranges

1 V Peak

Set the channel gain state to 1 Volt Peak.

Key Path	**AMPTD Y Scale, I Range | Q Range**
Initial S/W Revision	Prior to A.02.00

0.5 V Peak

Set the channel gain state to 0.5 Volt Peak.

Key Path	**AMPTD Y Scale, I Range | Q Range**
Initial S/W Revision	Prior to A.02.00

0.25 V Peak

Set the channel gain state to 0.25 Volt Peak.

Key Path	**AMPTD Y Scale, I Range | Q Range**
Initial S/W Revision	Prior to A.02.00

0.125 V Peak

Set the channel gain state to 0.125 Volt Peak.

Key Path	**AMPTD Y Scale, I Range | Q Range**

Initial S/W Revision	Prior to A.02.00

Scale / Div

Sets the units per vertical graticule division on the display. This function is only available when Scale Type (Log) is selected and the vertical scale is power. When Scale Type (Lin) is selected, Scale/Div is grayed out.

Key Path	**AMPTD Y Scale**
Remote Command	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`
Example	DISP:WIND:TRAC:Y:PDIV 5 DB
Dependencies	Scale/Div is grayed out in linear Y scale. Sending the equivalent SCPI command does change the Scale/Div, though it has no affect while in Lin.
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Initial S/W Revision	Prior to A.02.00

Scale Type

Chooses a linear or logarithmic vertical scale for the display and for remote data readout.

When Scale Type (Log) is selected, the vertical graticule divisions are scaled in logarithmic units. The top line of the graticule is the Reference Level and uses the scaling per division Scale/Div to assign values to the other locations on the graticule.

When Scale Type (Lin) is selected, the vertical graticule divisions are linearly scaled with the reference level value at the top of the display and zero volts at the bottom. Each vertical division of the graticule represents one-tenth of the Reference Level.

NOTE The Y Axis Unit used for each type of display is set by pressing Y Axis Unit. The analyzer remembers separate Y Axis Unit settings for both Log and Lin.

Key Path	**AMPTD Y Scale**
Remote Command	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:SPACing LINear|LOGarithmic` `:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:SPACing?`

Example	DISP:WIND:TRAC:Y:SPAC LOG DISP:WIND:TRAC:Y:SPAC?
Dependencies	If Normalize is on, Scale Type forced to Log and is grayed out.
Couplings	Changing the Scale Type always sets the Y Axis unit to the last unit specified for the current amplitude scale. In other words, we restore the Y Axis unit setting appropriate per log/lin.
Preset	LOG
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Presel Center

When this key is pressed, the centering of the preselector filter is adjusted to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when Presel Center is pressed, the analyzer will turn on the selected marker, perform a peak search, and then perform centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the analyzer, the analyzer performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the analyzer will first perform a peak search, and then perform centering on the marker's center frequency.

The value displayed on the **Presel Adjust** key will change to reflect the new preselector tuning (see **Presel Adjust**.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 19.

Key Path	**AMPTD Y Scale**
Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	POW:PCEN
Notes	Note that the rules outlined above under the key description apply for the remote command as well as the key. The result of the command is dependent on marker position, and so forth. Any message shown by the key press is also shown in response to the remote command.
Dependencies	• Grayed out if the microwave preselector is off.) • If the selected marker's frequency is below Band 1, advisory 0.5001 is generated and no action is taken. • Grayed out if entirely in Band 0. • Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.

Couplings	The active marker position determines where the centering will be attempted. If the analyzer s in a measurement such as averaging when centering is initiated, the act of centering the preselector will restart averaging but the first average trace will not be taken until the centering is completed.
Status Bits/OPC dependencies	When centering the preselector, *OPC will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to a READ or MEASure command. The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

If the selected marker is off, the analyzer will turn on a marker, perform a peak search, and adjust the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find.

If the selected marker is already on, the analyzer will attempt the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, therefore if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range.

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 18 is available.

For general purpose signal analysis, using Presel Center is recommended. Centering the filter minimizes the impact of long-term preselector drift. Presel Adjust can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

Key Path	**AMPTD Y Scale**
Scope	Meas Global
Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	POW:PADJ 100KHz POW:PADJ?

Notes	The value on the key reads out to 0.1 MHz resolution.
Dependencies	• Grayed out if microwave preselector is off.) • Grayed out if entirely in Band 0. • Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.
Preset	0 MHz
State Saved	The **Presel Adjust** value set by **Presel Center**, or by manually adjusting **Presel Adjust**, is not saved in Instrument State, and does not survive a Preset or power cycle.
Min	–500 MHz
Max	500 MHz
Default Unit	Hz
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:MW:PADJust [:SENSe]:POWer[:RF]:MMW:PADJust (These were undocumented commands for PSA which X-Series will accept)
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Remote Command:	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe|MMWave|EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`
Notes:	[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe|MMWave|EXTernal where: MWAV = 3–26 GHz MMWave = 26–50 GHz EXTernal = External Preselector Selection - PSA had multiple preselectors, and you could select which preselector to center. Since the X-Series will have only one preselector, the preselector selection softkey will no longer be available. However, in order to provide backward compatibility, we will support the remote command. The command form is a NOP The query will return MWAVe
Initial S/W Revision:	Prior to A.02.00

Y Axis Unit

Displays the menu keys that enable you to change the vertical (Y) axis amplitude unit. The analyzer retains the entered Y Axis Unit separately for both Log and Lin amplitude scale types. For example, if

Scale Type has been set to Log, and you set Y Axis Unit to dBm, pressing Scale Type (Log) sets the Y Axis Unit to dBm. If Scale Type has been set to Lin and you set Y Axis Unit to V, pressing Scale Type (Lin) sets the Y Axis Unit to V. Pressing Scale Type (Log) again sets the Y axis unit back to dBm.

NOTE The units of current (A, dBmA, dBuA) are calculated based on 50 ohms input impedance.

All four of the EMI units (dBµA/m, dBµV/m, dBG, dBpT) are treated by the instrument exactly as though they were dBuV. The user must load an appropriate correction factor using Amplitude Corrections for accurate and meaningful results.

If a SCPI command is sent to the analyzer which uses one of the EMI units as a terminator, the analyzer treats it as though DBUV had been sent as the terminator.

Remote Command	`:UNIT:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA|DBUVM|DBUAM|DBPT|DBG` `:UNIT:POWer?`
Example	UNIT:POW dBmV UNIT:POW?
Initial S/W Revision	Prior to A.02.00
Key Path	**AMPTD Y Scale**
Scope	Meas Global
Notes	The Y axis unit has either logarithmic or linear characteristics. The set of units that is logarithmic consists of dBm, dBmV, dBmA, dBµV, dBµA, dBµV/m, dBµA/m, dBpT, and dBG. The set if units that is linear consists of V, W, and A. The chosen unit will determine how the reference level and all the amplitude-related outputs like trace data, marker data, etc. read out.

Notes	The settings of Y Axis Unit and Scale Type, affect how the data is read over the remote interface. When using the remote interface no unit is returned, so you must know what the Y axis unit is to interpret the results: Example 1, set the following: Scale Type (Log) Y Axis Unit, dBm Scale/Div, 1 dB Ref Level, 10 dBm This sets the top line to 10 dBm with each vertical division representing 1 dB. Thus, if a point on trace 1 is on the fifth graticule line from the top, it represents 5 dBm and will read out remotely as 5. Example 2, set the following: Scale Type (Lin) Y Axis Unit, Volts Ref Level, 100 mV (10 mV/div) This sets the top line to 100 mV and the bottom line to 0 V, so each vertical division represents 10 mV. Thus, if a point on trace 1 is on the fifth graticule line from the top, it represents 50 mV and will read out remotely as 50.
Dependencies	If an amplitude correction with an Antenna Unit other than **None** is applied and enabled, then that antenna unit is forced and the key with that unit is the only Y Axis Unit available. All other Y Axis Unit keys are grayed out. If an amplitude correction with an Antenna Unit other than **None** is applied and enabled, and you then turn off that correction or set **Apply Corrections** to **No**, the Y Axis Unit that existed before the Antenna Unit was applied is restored.
Couplings	The analyzer retains the entered Y Axis Unit separately for both Log and Lin amplitude scale types
Preset	dBm for log scale, V for linear. The true 'preset' value is dBm, since at preset the Y Scale type is set to logarithmic.
State Saved	Saved in instrument state
Readback line	1-of-N selection
Modified at S/W Revision	A.02.00, A.04.00

dBm

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBm.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBM
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.

Readback	dBm
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

dBmV

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmV.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBMV
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBmV
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

dBmA

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmA.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBMA
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBmA
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

W

Sets the amplitude unit for the selected amplitude scale (log/lin) to watt.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW W
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	W
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

V

Sets the amplitude unit for the selected amplitude scale (log/lin) to volt.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW V
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	V
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

A

Sets the amplitude unit for the selected amplitude scale (log/lin) to Ampere.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW A
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	A
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

dBμV

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBμV.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBUV
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBμV
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

dBμA

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBμA.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBUA
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.

Readback	dBµA
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

dBµV/m

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBµV/m. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBUVM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBµV/m
Initial S/W Revision	A.02.00

dBµA/m

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBµA/m. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBUAM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBµA/m
Initial S/W Revision	A.02.00

dBpT

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBpT. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBPT
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBpT
Initial S/W Revision	A.02.00

dBG

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBG. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	**AMPTD Y Scale, Y Axis Unit**
Example	UNIT:POW DBG
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBG
Initial S/W Revision	A.02.00

Reference Level Offset

Adds an offset value to the displayed reference level. The reference level is the absolute amplitude represented by the top graticule line on the display.

See "More Information" on page 26

Remote Command	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel_ampl>` `:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet?`
Example	DISP:WIND:TRAC:Y:RLEV:OFFS 12.7 Sets the Ref Level Offset to 12.7 dB. The only valid suffix is dB. If no suffix is sent, dB will be assumed.
Initial S/W Revision	Prior to A.02.00
Key Path	**AMPTD Y Scale**
Scope	Meas Global
Preset	0 dBm
State Saved	Saved in instrument state
Min	The range for Ref Lvl Offset is variable. It is limited to values that keep the reference level within the range of –327.6 dB to 327.6 dB.
Max	327.6 dB
Modified at S/W Revision	A.04.00

More Information

Offsets are used when gain or loss occurs between a device under test and the analyzer input. Thus, the signal level measured by the analyzer may be thought of as the level at the input of an external amplitude conversion device. Entering an offset does not affect the trace position or attenuation value, just the value of the top line of the display and the values represented by the trace data. Thus, the values of exported trace data, queried trace data, marker amplitudes, trace data used in calculations such as N dB points, trace math, peak threshold, and so forth, are all affected by Ref Level Offset.

NOTE	Changing the offset causes the analyzer to immediately stop the current sweep and prepare to begin a new sweep, but the data will not change until the trace data updates, because the offset is applied to the data as it is taken. If a trace is exported with a nonzero Ref Level Offset, the exported data will contain the trace data with the offset applied.

The maximum reference level available is dependent on the reference level offset. That is, Ref Level - Ref Level Offset must be in the range –170 to +30 dBm. For example, the reference level value range can be initially set to values from –170 dBm to 30 dBm with no reference level offset. If the reference level is first set to –20 dBm, then the reference level offset can be set to values of –150 to +50 dB.

If the reference level offset is first set to –30 dB, then the reference level can be set to values of –200 dBm to 0 dBm. In this case, the reference level is “clamped” at 0 dBm because the maximum limit of +30 dBm is reached with a reference level setting of 0 dBm with an offset of –30 dB. If instead, the reference level offset is first set to 30 dB, then the reference level can be set to values of –140 to +60 dBm.

µW Path Control

The **µW Path Control** functions include the **µW Preselector Bypass** (Option MPB) and **Low Noise Path** (Option LNP) controls in the High Band path circuits.

When the µW Preselector is bypassed, the user has better flatness, but will be subject to spurs from out of band interfering signals. When the Low Noise Path is enabled, the analyzer automatically switches around certain circuitry in the high frequency bands which can contribute to noise, when it is appropriate based on other analyzer settings.

For most applications, the preset state is Standard Path, which gives the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wearout in the hardware switches. For applications that utilize the wideband IF paths, the preset state is the µW Preselector Bypass path, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector’s bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

Users may choose Low Noise Path Enable. It gives a lower noise floor, especially in the 21–26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does the Low Noise Path, however its compression threshold and third-order intercept are much poorer than that of the non-preamp Low Noise Path. There are some applications, typically for signals around 30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range.

Key Path	**Amplitude**
Mode	SA, BASIC, PNOISE, VSA
Scope	Meas Global

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD|LNPath|MPBypass` `[:SENSe]:POWer[:RF]:MW:PATH?`
Example	:POW:MW:PATH LNP ! Enables the Low Noise path
Notes	If a Presel Center is performed, the analyzer will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean “when the low noise path is enabled” but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** . In the case where the DC Block is switched in the analyzer is now AC coupled. However, if the user has selected DC coupling, the UI will still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the analyzer could switch out the low noise path at any time and hence go back to being DC coupled. Alignment switching ignores the settings in this menu, and restores them when finished.
Dependencies	Blanked in BBIQ
Preset	All modes other than IQ Analyzer and VXA modes: STD IQ Analyzer and VXA mode: MPB option present and licensed: MPB MPB option not present and licensed: STD
State Saved	Save in State
Readback	Value selected in the submenu
Initial S/W Revision	A.04.00

Standard Path

This path gives the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession.

In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

Key Path	**Amplitude, µW Path Control**
Example	:POW:MW:PATH STD
Readback Text	Standard Path
Initial S/W Revision	A.04.00

Low Noise Path Enable

You may choose Low Noise Path Enable, which gives a lower noise floor under some circumstances, particularly when operating in the 21–26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The analyzer is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

See “More Information” on page 29

Key Path	**Amplitude, µW Path Control**
Measurement	Swept SA
Example	:POW:MW:PATH LNP
Notes	For measurements that use IQ acquisition, the low noise path is used when the Center Frequency is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFT’s in the Swept SA measurement; they use the same rules as swept measurements.
Dependencies	Key is blanked if current mode does not support it. Key is grayed out if mode supports it but current measurement does not support it. Unless Option LNP is present and licensed, key is blank and if SCPI command sent, error –241, "Hardware missing; Option not installed" is generated.
Readback Text	Low Noise Path Enable
Initial S/W Revision	A.04.00

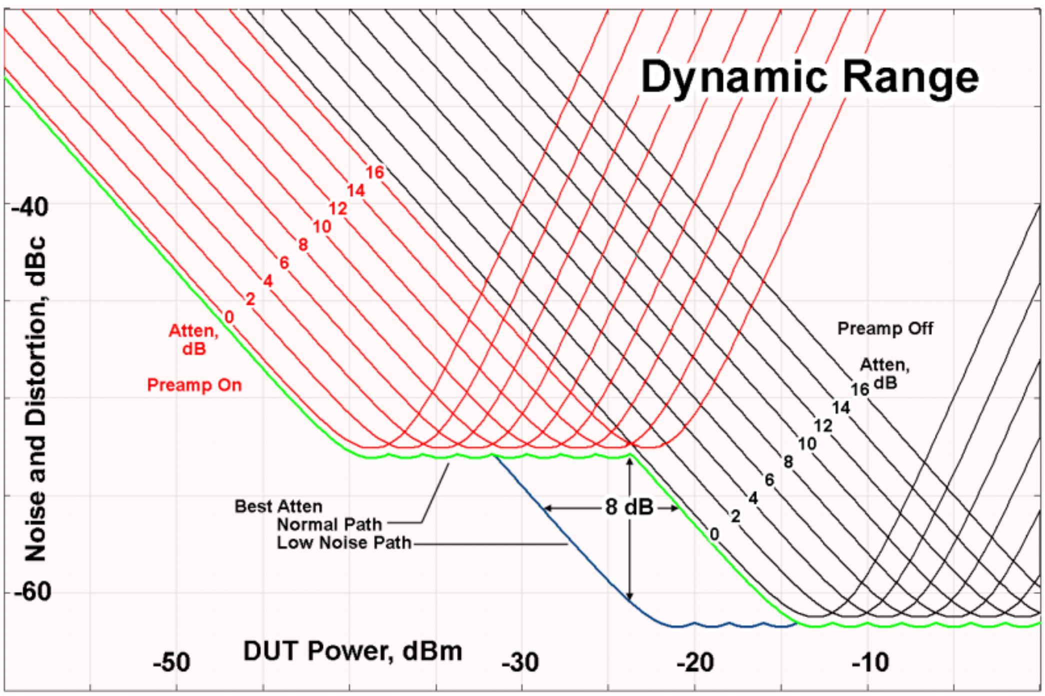
More Information

The user should understand that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

The user should also understand that the bypass switch is a mechanical switch and has finite life; so if the **Low Noise Path** is enabled, it is possible to cause frequent cycling of this switch by frequently changing analyzer settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the analyzer performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path. There are some applications, typically for signals around 30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an analyzer at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both analyzer noise and analyzer TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the analyzer input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

μW Preselector Bypass

This key toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected.

The preselected path is the normal path for the analyzer.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Key Path	**Amplitude, μW Path Control**
Example	:POW:MW:PATH MPB
Dependencies	Key is blanked if current mode does not support it. Key is grayed out if mode supports it but current measurement does not support it. Key is blank unless Option MPB is present and licensed. If SCPI command sent when MPB not present, error –241, "Hardware missing; Option not installed" is generated.
Readback Text	μW Preselector Bypass
Initial S/W Revision	A.04.00

Example	:POW:MW:PRES OFF Bypasses the microwave preselector
Preset	ON
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON|OFF|0|1 [:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?
Backwards Compatibility Notes	The ON parameter sets the STD path. The OFF parameter sets Path MPB.

Internal Preamp

Accesses a menu of keys that control the internal preamps. Turning on the preamp gives a better noise figure, but a poorer TOI to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp the instrument will also account for that. The displayed result will always reflect the correct gain.

Key Path	**AMPTD Y Scale**
Scope	Meas Global

Remote Command	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF|ON|0|1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the key is not shown. The preamp is not available when the electronic/soft attenuator is enabled.
Preset	OFF
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Key Path	**AMPTD Y Scale, Internal Preamp**
Scope	Meas Global
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW|FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the key is not shown. If a POW:GAIN:BAND FULL command is sent when a low band preamp is available, the preamp band parameter is to LOW instead of FULL, and an "Option not installed" message is generated.
Preset	LOW
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Off

Turns the internal preamp off

Key Path	**AMPTD Y Scale, Internal Preamp**
Example	:POW:GAIN OFF
Readback	Off
Initial S/W Revision	Prior to A.02.00

Low Band

Sets the internal preamp to use only the low band.

The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the **Low Band** key label.

Key Path	**AMPTD Y Scale, Internal Preamp**

Example	:POW:GAIN ON :POW:GAIN:BAND LOW
Readback	Low Band
Initial S/W Revision	Prior to A.02.00

Full Range

Sets the internal preamp to use its full range. The low band (0–3.6 GHz or 0–3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp.

The frequency range of the installed (optional) preamp is displayed in square brackets on the **Full Range** key label. If the high band option is not installed the Full Range key does not appear.

Key Path	**AMPTD Y Scale, Internal Preamp**
Example	:POW:GAIN ON :POW:GAIN:BAND FULL
Readback	Full Range
Initial S/W Revision	Prior to A.02.00

Auto Couple

The Auto Couple feature provides a quick and convenient way to automatically couple multiple instrument settings. This helps ensure accurate measurements and optimum dynamic range. When the Auto Couple feature is activated, either from the front panel or remotely, all parameters of the current measurement which have an Auto/Manual mode are set to Auto mode and all measurement settings dependent on (or coupled to) the Auto/Man parameters are automatically adjusted for optimal performance.

However, the Auto Couple keyactions are confined to the current measurement only. It does not affect other measurements in the mode, and it does not affect markers, marker functions, or trace or display More Informationattributes.

See “More Information” on page 34

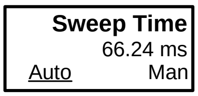
Key Path	**Front-panel key**
Remote Command	`:COUPle ALL|NONE`
Example	:COUP ALL
Notes	:COUPle ALL puts all Auto/Man parameters in Auto mode (equivalent to pressing the **Auto Couple** key). :COUPLE NONE puts all Auto/Man parameters in manual mode. It decouples all the coupled instrument parameters and is not recommended for making measurements.
Initial S/W Revision	Prior to A.02.00

More Information

There are two types of functions that have Auto/Manual modes.

Auto/Man Active Function keys

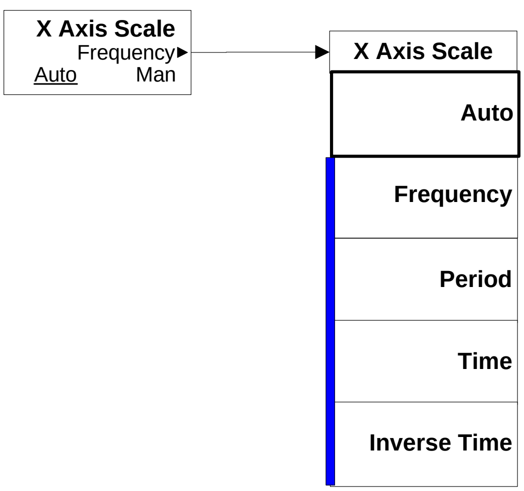
An Auto/Man toggle key controls the binary state associated with an instrument parameter by toggling between "Auto" (where the parameter is automatically coupled to the other parameters it is dependent upon) and "Man" (where the parameter is controlled independent of the other parameters), as well as making the parameter the active function. The current mode is indicated on the softkey with either "Auto" or "Man" underlined as illustrated below.



vsd07

Auto/Man 1-of-N keys

An Auto/Man 1-of-N key allows you to manually pick from a list of parameter values, or place the function in "Auto" in which case the value is automatically selected (and indicated) as shown below. If in Auto, Auto is underlined on the calling key. If in manual operation, manual is indicated on the calling key. But the calling key does not actually toggle the function, it simply opens the menu.



vsd08

Cont (Continuous Measurement/Sweep)

Sets the analyzer for Continuous measurement operation. The single/continuous state is Meas Global so the setting will affect all measurements. If you are Paused, pressing **Cont** does a Resume.

Remote Command:	`:INITiate:CONTinuous OFF|ON|0|1` `:INITiate:CONTinuous?`
Example:	:INIT:CONT 0 puts analyzer in Single measurement operation. :INIT:CONT 1 puts analyzer in Continuous measurement operation
Preset:	ON (Note that SYST:PRESet sets INIT:CONT to ON but *RST sets INIT:CONT to OFF)
State Saved:	Saved in Instrument State
Key Path:	**Front-panel key**
Initial S/W Revision:	Prior to A.02.00

In Swept SA Measurement (Spectrum Analysis Mode):

The analyzer takes repetitive sweeps, averages, measurements, etc, when in Continuous mode. When the average count reaches the **Average/Hold Number** the count stops incrementing, but the analyzer keeps sweeping. See the Trace/Detector section for the averaging formula used both before and after the **Average/Hold Number** is reached. The trigger condition must be met prior to each sweep. The type of trace processing for multiple sweeps, is set under the Trace/Detector key, with choices of **Trace Average**, **Max Hold**, or **Min Hold**.

In Other Measurements/Modes:

With **Avg Number** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the analyzer continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg Number** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg Number is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results. But sometimes it only applies to the numeric results.

If the analyzer is in Single measurement, pressing the **Continuous** key does not change k and does not cause the sweep to be reset; the only action is to put the analyzer into Continuous measurement operation.

If it is already in continuous sweep:

- the INIT:CONT 1 command has no effect
- the INIT:CONT 0 command will place the analyzer in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go

to the idle state.

FREQChannel

Accesses a menu of keys that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements – they do not change as you change measurements.   Settings like these are called "Meas Global" and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Auto Tune

Auto Tune is an immediate action key. When it is pressed, it causes the analyzer to change Center Frequency to the strongest signal in the tunable span of the analyzer, excluding the LO. It is designed to quickly get you to the most likely signal(s) of interest, with no signal analysis knowledge required. As such, there are no configurable parameters for this feature. There are only pre-selected values that work in most real world situations.

NOTE	You may see a slight pause before the signal of interest is presented at midscreen.

Remote Command:	`[:SENSe]:FREQuency:TUNE:IMMediate`
Initial S/W Revision:	Prior to A.02.00
Key Path:	**FREQ Channel**

Center Freq

Sets the frequency that corresponds to the horizontal center of the graticule (when frequency Scale Type is set to linear). While adjusting the Center Frequency the Span is held constant, which means that both Start Frequency and Stop Frequency will change.

Pressing Center Freq also sets the frequency entry mode to Center/Span. In Center/Span mode, the center frequency and span values are displayed below the graticule, and the default active function in the Frequency menu is **Center Freq**.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global Settings** key in its **Mode Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your analyzer has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

See “RF Center Freq” on page 39

See “I/Q Center Freq” on page 39

See “Center Frequency Presets” on page 38

Key Path	**FREQ Channel**
Scope	Meas Global
Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`
Example	FREQ:CENT 50 MHz FREQ:CENT UP !changes the center frequency to 150 MHz if you use FREQ:CENT:STEP 100 MHz !to set the center frequency step size to 100 MHz FREQ:CENT?
Notes	This command sets either the RF or I/Q Center Frequency depending on the selected input. For RF input it is equivalent to FREQ:RF:CENT For I/Q input it is equivalent to FREQ:IQ:CENT Preset and Max values are dependant on Hardware Options (503, 507, 508, 513, 526)
Dependencies	The Center Frequency can be limited by Start or Stop Freq limits, if the Span is so large that Start or Stop hit their limit.
Couplings	When operating in “swept span”, any value of the Center Frequency or Span that is within the frequency range of the analyzer is allowed when the value is being set through the front panel numeric key pad or the SCPI command. The other parameter is forced to a different value if needed, to keep the Start and the Stop Frequencies within the analyzer’s frequency range
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input.. See “Center Frequency Presets” on page 38, “RF Center Freq” on page 39, and “I/Q Center Freq” on page 39.
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input.. See “Center Frequency Presets” on page 38, “RF Center Freq” on page 39, and “I/Q Center Freq” on page 39.
Max	Depends on instrument maximum frequency, mode, measurement, and selected input.. See “Center Frequency Presets” on page 38, “RF Center Freq” on page 39, and “I/Q Center Freq” on page 39.

Default Unit	Hz
Status Bits/OPC Dependencies	non-overlapped
Initial S/W Revision	Prior to A.02.00

Center Frequency Presets

Model numbers N9010A, N9020A, N9030A:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503	1.805 GHz	3.6 GHz	3.7 GHz
507	3.505 GHz	7.0 GHz	7.1 GHz
508	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526	13.255 GHz	26.5 GHz	27.0 GHz

Model number N9000A.

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503	1.505 GHz	3.0 GHz	3.08 GHz
507	3.755 GHz	7.5 GHz	7.58 GHz

The following table shows the Center Frequency Presets for modes other than Spectrum Analyzer:

Mode	CF Preset for RF
WCDMA	1 GHz
WIMAXOFDMA,	1 GHz
BASIC	1 GHz
ADEMOD	1 GHz
VSA	1 GHz
TDSCDMA	1 GHz
PNOISE	1 GHz
GSM	935.2 MHz
NFIGURE	1.505 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	FREQ:RF:CENT 30 MHz
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.
Preset	See table above
State Saved	Saved in instrument state.
Min	–79.999995 MHz
Max	See table above. Basically instrument maximum frequency – 10 Hz minimum span. If the knob or step keys are being used, depends on the value of the other three interdependent parameters
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	FREQ:IQ:CENT: 30 MHz

Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Preset	0 Hz
State Saved	Saved in instrument state.
Min	–40.049995 MHz
Max	40.049995 MHz
Initial S/W Revision	Prior to A.02.00

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer.

Note that the start and stop frequencies also step by the CF Step value.

Key Path	**FREQ Channel**

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF|ON|0|1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	FREQ:CENT:STEP:AUTO ON FREQ:CENT:STEP 500 MHz FREQ:CENT UP !increases the current center frequency value by 500 MHz FREQ:CENT:STEP? FREQ:CENT:STEP:AUTO?
Notes	Preset and Max values are dependant on Hardware Options (503, 508, 513, 526)
Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent –3 dB RBW value.

Preset	Auto ADEMOD: 1 MHz ON
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). (that is, 27 GHz max freq instrument has a CF step range of +/– 27 GHz)
Max	the maximum frequency of the instrument. (that is, 27 GHz max freq instrument has a CF step range of +/– 27 GHz)
Default Unit	Hz
Status Bits/OPC dependencies	non-overlapped
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Freq Offset

Enables you to set a frequency offset value to account for frequency conversions outside of the analyzer. This value is added to the display readout of the marker frequency, center frequency, start frequency, stop frequency, and all other absolute frequency settings in the analyzer including frequency count. When a frequency offset is entered, the value appears below the center of the graticule. To eliminate an offset, perform a Mode Preset or set the frequency offset to 0 Hz.

See “More Information” on page 42.

Remote Command	`[:SENSe]:FREQuency:OFFSet <freq>` `[:SENSe]:FREQuency:OFFSet?`
Example	FREQ:OFFS 10 MHz
Default Unit	Hz
Initial S/W Revision	Prior to A.02.00
Key Path	**FREQ Channel**
Scope	Meas Global
Notes	Preset and Max values are depending on Hardware Options (503, 507, 508, 513, 526)
Dependencies	Frequency Offset is not available when the frequency scale is set to Log
Preset	See the table in See “Center Frequency Presets” on page 38
State Saved	Saved in instrument state
Min	–500 GHz
Max	500 GHz
Status Bits/OPC dependencies	non-overlapped

Backwards Compatibility SCPI	DISPlay:WINDow[1]:TRACe:X[:SCALe]:OFFSet
Modified at S/W Revision	A.04.00

More Information

This command does not affect any bandwidths or the settings of relative frequency parameters such as delta markers or span. It does not affect the current hardware settings of the analyzer, but only the displayed frequency values. Entering an offset does not affect the trace position or display, just the value of the start and stop frequency and the values represented by the trace data. The frequency values of exported trace data, queried trace data, markers, trace data used in calculations such as N dB points, trace math, etc., are all affected by Freq Offset. Changing the offset, even on a trace that is not updating will immediately change all of the above, without taking new data.

NOTE If a trace is exported with a nonzero Freq Offset, the exported data will contain the trace data with the offset applied. Therefore, if that trace were to be imported back into the analyzer, you would want Freq Offset to be 0, or the offset would be applied again to data which is already offset. No such care need be taken when saving a State+Trace file because the data and state are saved together.

Input/Output

The Input/Output features are common across multiple Modes and Measurements. These common features are described in this section. See the Measurement description for information on features that are unique.

The Input/Output key accesses the softkeys that control the Input/Output parameters of the instrument. In general, these are functions associated with external connections to the analyzer, either to the inputs or the outputs. Since these connections tend to be fairly stable within a given setup, in general the input/output settings do not change when you Preset the analyzer.

Other functions related to the input/output connections, but which tend to change on a measurement by measurement basis, can be found under **Trigger** and **AMPTD Y Scale.** In addition, some of the digital I/O bus configurations can be found under **System**.

NOTE The functions in the Input/Output menu are "global" (common) to all Modes (applications). But individual Input/Output functions only appear in a Mode if they apply to that Mode. Functions that apply to a Mode but not to all measurements in the Mode may be grayed-out in some measurements.

See “Input/Output variables - Preset behavior” on page 43

The Input Port selection is the first menu under **Input/Output**:

Remote Command:	`[:SENSe]:FEED RF|AIQ|IQ|IONLy|QONLy|INDependent|AREFerence` `[:SENSe]:FEED?`
Backwards Compatibility SCPI:	The legacy parameter [:SENSe]:FEED AREFerence is aliased to the new command [:SENSe]:FEED:AREF REF50 for backwards compatibility. This causes the input to be switched to the 50 MHz calibrator.
Preset:	This setting is unaffected by a Preset or power cycle. It survives a Mode Preset and mode changes. It is set to RF on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved:	Saved in instrument state
Key Path:	**Front-panel key**
Initial S/W Revision:	Prior to A.02.00

Input/Output variables - Preset behavior

Virtually all the input/output settings are NOT a part of mode preset. They can be set to their default value by one of the three ways - by using the Restore Input/Output Defaults key on the first page of the input/output menu, by using the System->Restore System Defaults->Input/Output Settings or by using the System -> Restore System Defaults->All. Also, they survive Preset and Power cycle.

A very few of the Input/Output settings do respond to a Mode Preset; for example, if the Calibrator is on it turns off on a Preset, and if DC coupling is in effect it switches to AC on a Preset. These exceptions are made in the interest of reliability and usability, which overrides the need for absolute consistency. Exceptions are noted in the SCPI table for the excepted functions.

RF Input

Selects the front-panel RF input port to be the analyzer signal input. If RF is already selected, pressing this key accesses the RF input setup functions.

Example:	[:SENSe]:FEED RF
Key Path:	**Input/Output**
Readback:	The current input impedance settings are Readback to this key i.e. "XX, ZZ" where XX is AC or DC and ZZ is 50 or 75
Initial S/W Revision:	Prior to A.02.00

Input Z Correction

Sets the input impedance for unit conversions. This affects the results when the y-axis unit is voltage or current units (dBmV, dBµV, dBµA, V, A), but not when it is power units (dBm, W). The impedance you select is for computational purposes only, since the actual impedance is set by internal hardware to 50 ohms. Setting the computational input impedance to 75 ohms is useful when using a 75 ohm to 50 ohm adapter to measure a 75 ohm device on an analyzer with a 50 ohm input impedance.

There are a variety ways to make 50 to 75 ohm transitions, such as impedance transformers or minimum loss pads. The choice of the solution that is best for your measurement situation requires balancing the amount of loss that you can tolerate with the amount of measurement frequency range that you need. If you are using one of these pads/adaptors with the **Input Z Corr** function, you might also want to use the **Ext Gain** key. This function is used to set a correction value to compensate for the gain (loss) through your pad. This correction factor is applied to the displayed measurement values.

Remote Command:	`[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] 50|75` `[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?`
Example:	CORR:IMP 75 sets the input impedance correction to 75 ohms. CORR:IMP?
Preset:	This is unaffected by a Preset but is set to 50 ohms on a "Restore Input/Output Defaults" or "Restore System Defaults->All" Some instruments/options may have 75 ohms available.
State Saved:	Saved in instrument state
Key Path:	**Input/Output, RF Input**
Readback:	50 Ω or 75 Ω. Current setting reads back to the RF key.

Initial S/W Revision:	Prior to A.02.00

RF Coupling

Specifies alternating current (AC) or direct current (DC) coupling at the analyzer RF input port. Selecting AC coupling switches in a blocking capacitor that blocks any DC voltage present at the analyzer input. This decreases the input frequency range of the analyzer, but prevents damage to the input circuitry of the analyzer if there is a DC voltage present at the RF input.

In AC coupling mode, you can view signals below the corner frequency of the DC block, but below a certain frequency the amplitude accuracy is not specified. The frequency below which specifications do not apply is:

X-Series Model	Lowest Freq for meeting specs when AC coupled	Lowest Freq f specs when D
N9000A	100 kHz	n/a
N9010A	10 MHz	9 kHz
N9020A	10 MHz	3 Hz
N9030A	10 MHz	3 Hz

Some amplitude specifications apply only when coupling is set to DC. Refer to the appropriate amplitude specifications and characteristics for your analyzer.

When operating in DC coupled mode, ensure protection of the analyzer input circuitry by limiting the DC part of the input level to within 200 mV of 0 Vdc. In AC or DC coupling, limit the input RF power to +30 dBm (1 Watt).

Remote Command:	`:INPut:COUPling AC|DC` `:INPut:COUPling?`
Example:	INP:COUP DC
Dependencies:	This key does not appear in models that are always AC coupled. When the SCPI command to set DC coupling is sent to these models, it results in the error “Illegal parameter value;This model is always AC coupled” In these models, the SCPI query INP:COUP? always returns AC.
Preset:	AC
State Saved:	Saved in instrument state.
Key Path:	**Input/Output, RF Input**
Initial S/W Revision:	Prior to A.02.00
Modified at S/W Revision:	A.03.00

I/Q

This feature is not available unless the “Baseband I/Q (Option BBA)” on page 46 is installed.

Selects the front-panel I/Q input ports to be the analyzer signal input. If I/Q is already selected, pressing this key accesses the I/Q setup menu.

Example	FEED AIQ
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output**
Mode	BASIC, CDMA2K, EDGEGSM, TDSCMDA, VSA89601, WIMAXOFDMA
Notes	Not all measurements support the use of the I/Q signal input. When I/Q is selected in a measurement that does not support it, the "Meas invalid with I/Q inputs" error condition occurs.
Notes	The parameters IQ|IONLy|QONLy are only supported for backwards compatibility The E44406 SCPI has the following that corresponds to FEED:IQ:TYPE for X-Series. [:SENSe]:FEED IQ|IONLy|QONLy [:SENSe]:FEED? [:SENSe]:FEED IQ will set the I/Q path to IQ [:SENSe]:FEED IONLy will set the I/Q path to I Only [:SENSe]:FEED QONLy will set the I/Q path to QOnly Note [:SENSe]:FEED? will not be backward compatible. The query [:SENSe]:FEED? will always returns AIQ whatever the type of legacy parameters IQ|IONLy|QONLy has been used.

Baseband I/Q (Option BBA)

The Baseband I/Q functionality is a hardware option. It is option BBA. If the option is not installed, none of the I/Q functionality is enabled.

The Baseband I/Q has four input ports and one output port. The input ports are I, I-bar, Q, and Q-bar. The I and I-bar together compose the I channel and the Q and Q-bar together compose the Q channel. Each channel has two modes of operation, Single-Ended (also called "unbalanced") and Differential Input (also called "balanced"). When in Single-Ended operation, only the main port (I or Q) is used and the complementary port (I-bar or Q-bar) is ignored. When in Differential Input mode, both main and complementary ports are used.

The input settings (range, attenuation, skew, impedance, external gain) apply to the channels, not the individual ports.

The system supports a variety of 1 MΩ input passive probes as well as the Agilent 113x Series active differential probes using the Infinimax probe interface.

The Agilent 113x Series active probes can be used for both single ended and differential measurements. In either case a single connection is made for each channel (on either the I or Q input). The input is automatically configured to 50 Ω single ended and the probe power is supplied through the Infinimax interface. The probe can be configured for a variety of input coupling and low frequency rejection modes. In addition, a wide range of offset voltages and probe attenuation accessories are supported at the probe interface. The active probe has the advantage that it does not significantly load the circuit under test, even with unity gain probing.

With passive 1 MΩ probes, the probe will introduce a capacitive load on the circuit, unless higher attenuation is used at the probe interface. Higher attenuation reduces the signal level and degrades the signal-to-noise-ratio of the measurement. Passive probes are available with a variety of attenuation values for a moderate cost. Most Agilent passive probes can be automatically identified by the system, setting the input impedance setting required as well as the nominal attenuation. For single ended measurements a single probe is used for each channel. Other passive probes can by used, with the attenuation and impedance settings configured manually.

For full differential measurements, the system supports probes on each of the four inputs. The attenuation of the probes should be the same for good common mode rejection and channel match.

Both active and passive probes in single ended and differential configurations can be calibrated. This calibration uses the Cal Out BNC connection and a probe connection accessory. The calibration achieves excellent absolute gain flatness in a probed measurement. It matches both the gain and frequency response of the I and Q channels as well as any delay skew, resulting in high accuracy in derived measurements such as Error Vector Magnitude (EVM).

When a probe is connected a status message will be displayed. The message will indicate if calibration data is available or not. Calibration data is saved for each type of probe (including "none") for each port and will be reapplied whenever that type of probe is re-connected to the same port. For probes with EEPROM identification, the calibration data will be stored based on the unique probe identifier and will reapply data for that particular probe if it is available. The data will not follow a probe from one port to another. For probes without EEPROM identification, the instrument cannot distinguish between different probes of the same type and it will use the data from the last calibration for that probe type on that port.

When in differential mode, both the main and complementary probes are expected to be of the same type.

In some situations, the I and Q channels should be configured identically. In other situations it is convenient to control them independently. Some menus have a "Q Same as I" setting that will cause the Q channel configuration to mirror the I channel configuration, avoiding the overhead of double data entry when the channels should be the same.

The output port is for calibrating the I/Q input ports, although it can also be manually controlled.

There are two types of calibrations available: cable calibration and probe calibration. The cable calibration will guide the user through connecting each input port in turn. All ports must be calibrated together. The probe calibration is done for a specific channel (I or Q). If in Single-Ended mode, only the main port is calibrated. When in Differential Input mode, the user is guided through calibrating both main and complementary ports.

The front panel I/Q port LEDs indicate the current state of that port. On (green) indicates it is active, and off (dark) indicates it is not in use. For example, the Cal Out port LED is on if and only if there is signal coming out of that port.

The input is a context and some parameters have separate values for each context. The SCPI for these parameters has an optional "[:RF|IQ]" node. If the specific context is omitted, the command acts on the current input context's value. Here are the parameters that are input context sensitive:

- Center Frequency

- Trigger Source

It is important to distinguish between the I and Q input ports and the displayed I and Q data values. The I and Q input ports feed into a digital receiver that does digital tuning and filtering. The I and Q data seen by the user (either on the display or through SCPI) corresponds to the real ("I") and the imaginary ("Q") output from the digital receiver. When the input path is I+jQ or I Only and the center frequency is 0 Hz the I input ends up in as the real output from the receiver and appears as "I" data. Likewise, when the input path is I+jQ and the center frequency is 0 Hz, the Q input ends up as the imaginary output from the receiver and appears as "Q" data. However, when the input path is Q Only, the Q input is sent to the receiver as Q+j0, so the receiver output has the Q input coming out on the real output, and so in Q Only, the signal from the Q input port appears as the "I" data. Another situation where the I and Q data do not necessarily correspond directly to the I and Q inputs is when the center frequency is non-zero. The digital processing involved in the tuning is a complex operation. This will result in I Only data appearing as both "I" and "Q" data, the same as that signal would appear if seen through the RF input port.

I/Q Path

Selects which I/Q input channels are active. The LED next to each I/Q input port will be on when that port is active.

The analysis bandwidth for each channel is the same as that of the instrument. So, for example, the base N9020A has a bandwidth of 10 MHz. With I/Q input the I and Q channels would each have an analysis bandwidth of 10 MHz, giving 20 MHz of bandwidth when the I/Q Path is I+jQ. With option B25, the available bandwidth becomes 25 MHz, giving 25 MHz each to I and Q and 50 MHz to I+jQ.

I/Q voltage to power conversion processing is dependent on the I/Q Path selected.

- With I+jQ input we know that the input signal may not be symmetrical about 0 Hz, because it has a complex component. Therefore, above 0 Hz only the positive frequency information is displayed, and below 0 Hz only the negative frequency information is displayed.
- With all other Input Path selections, the input signal has no complex component and therefore is always symmetrical about 0 Hz. In this case, by convention, the power conversion shows the combined voltage for both the positive and negative frequencies. The information displayed below 0 Hz is the mirror of the information displayed above 0 Hz.   This results in a power reading 6.02 dB higher (for both) than would be seen with only the positive frequency voltage. Note also that, in this case the real signal may have complex modulation embedded in it, but that must be recovered by further signal processing.

Remote Command	`[:SENSe]:FEED:IQ:TYPE IQ|IONLy|QONLy|INDependent` `[:SENSe]:FEED:IQ:TYPE?`
Example	Set the input to be both the I and Q channels, combined as I + j * Q. FEED:IQ:TYPE IQ
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q**
Notes	The Independent I and Q selection is only available in GPVSA
Preset	IQ

State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	I+jQ | I Only | Q Only | Independent I and Q
Readback Text	I+jQ | I Only | Q Only | Ind I/Q

Remote Command:	`:INPut[1]:IQ:TYPE IQ|I|Q` `:INPut[1]:IQ:TYPE?`
Preset:	IQ
Initial S/W Revision:	Prior to A.02.00

I+jQ

Sets the signal input to be both the I and Q channels. The I and Q channel data will be combined as I + j * Q.

Key Path	**Input/Output, I/Q, I/Q Path**
Example	Set the input to be both the I and Q channels, combined as I + j * Q. FEED:IQ:TYPE IQ
Initial S/W Revision	Prior to A.02.00

I Only

Sets the signal input to be only the I channel. The Q channel will be ignored. The data collected is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant.

Key Path	**Input/Output, I/Q, I/Q Path**
Example	Set the input to be only the I channel. FEED:IQ:TYPE IONL
Initial S/W Revision	Prior to A.02.00

Q Only

Sets the signal input to be only the Q channel. The I channel will be ignored. The Q channel will be sent to the digital receiver block as Q+j0. The receiver's output is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant. Note that since the receiver's real output is displayed as the "I" data, when the center frequency is 0, the Q Only input appears as the "I" data.

Key Path	**Input/Output, I/Q, I/Q Path**
Example	Set the input to be only the Q channel. FEED:IQ:TYPE QONL

Initial S/W Revision	Prior to A.02.00

Independent I and Q

Sets the signal input to be both the I and Q channels, but as independent inputs. It is equivalent to treating I as channel 1 and Q as channel 2 in an oscilloscope. Each channel's data is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant.

This selection is only available in VXA.

Example	Turn on both I and Q channels and treat I as channel 1 and Q as channel 2. FEED:IQ:TYPE IND
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I/Q Path**
Notes	The Independent I and Q selection is only available in GPVSA
Readback Text	Ind I/Q

I Setup

Access the channel setup parameters for the I channel.

Key Path	**Input/Output, I/Q**
Initial S/W Revision	Prior to A.02.00

I Differential Input

Selects differential input on or off for the I channel. For differential input (also called balanced input), the analyzer uses both main and complementary ports. When differential input is off (also called single-ended or unbalanced input), the analyzer uses only the main port.

Remote Command	`:INPut:IQ[:I]:DIFFerential OFF|ON|0|1` `:INPut:IQ[:I]:DIFFerential?`
Example	Put the I channel in Differential Input mode INP:IQ:DIFF ON
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I Setup**
Notes	When Differential Input = On, the analyzer will check for attenuation mismatches between the I and I-bar ports. If the difference in attenuation values exceeds 0.5 dB an error condition will be set.

Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Analyzer will use only the main port and the key will show that the Analyzer's Differential Input mode is Off (indicating that the complementary port not in use). When Q Same as I is On, the value set for I will also be copied to Q.
Preset	Off
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	Off | On

Remote Command:	`:INPut[1]:IQ:BALanced[:STATe] OFF|ON|0|1` `:INPut[1]:IQ:BALanced[:STATe]?`
Preset:	OFF
Notes:	This backwards compatibility SCPI command was for an instrument without independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command Q Same as I should be set to On.
Initial S/W Revision:	Prior to A.02.00

I Input Z

Selects the input impedance for the I channel. The impedance applies to both the I and I-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Remote Command	`:INPut[1]:IQ[:I]:IMPedance LOW|HIGH` `:INPut[1]:IQ[:I]:IMPedance?`
Example	Set the I channel input impedance to 1 MΩ INP:IQ:IMP HIGH
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I Setup**
Notes	LOW = 50 Ω, HIGH = 1 MΩ
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled and the value is set to match the probe. When no probe is sensed on Q and Q Same as I is On, the value set for I will also be copied to Q.

Preset	LOW
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	50 Ω | 1 MΩ

I Skew

Sets the skew factor for the I channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling.

Key Path	**Input/Output, I/Q, I Setup**
Remote Command	`[:SENSe]:CORRection:IQ[:I]:SKEW <seconds>` `[:SENSe]:CORRection:IQ[:I]:SKEW?`
Preset	0
State Saved	Yes This is unaffected by Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	0 s to 100 ns
Example	Delay the data for the I channel by 10 ns. CORR:IQ:SKEW 10 ns
Initial S/W Revision	Prior to A.02.00

I Probe

Access the probe setup parameters for the I channel. See "I/Q Probe Setup" on page 56.

Key Path	**Input/Output, I/Q, I Setup**
State Saved	No
Readback Text	[<I port probe id>] This is reporting the type of probe sensed on the I port. There is no parameter for overriding what is sensed.
Initial S/W Revision	Prior to A.02.00

Combined Differential/Input Z (Remote Command Only)

This is Remote Command only (no front panel) and is for backwards compatibility only. It combines the Differential Input and Input Z selections into a single SCPI command.

Remote Command:	`:INPut:IMPedance:IQ U50|B50|U1M|B1M` `:INPut:IMPedance:IQ?`

Preset:	U50
Notes:	The enum values translate as follows: U50: Differential Input = Off, Input Z = 50Ω B50: Differential Input = On, Input Z = 50Ω U1M: Differential Input = Off, Input Z = 1 MΩ B1M: Differential Input = On, Input Z = 1 MΩ This command is for backwards compatibility. It combines the Input Z (50Ω or 1 MΩ) parameter with the Differential Input (Off = "Unbalanced", On = "Balanced") parameter into a single enumeration. This backwards compatibility SCPI command was for an instrument without independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command Q Same as I should be set to On. Also, note the subtle difference between this SCPI command and the backwards compatibility command for Input Z. The Input Z SCPI has "IQ" before "IMP" while this command has that order reversed.
Couplings:	This command does not have an independent parameter, but instead is tied to the Differential Input and Input Z parameters. The coupling for those parameters apply to this command too.
Example:	:INPut:IMPedance:IQ U50 This is equivalent to the following two SCPI commands: :INP:IQ:DIFF OFF :INP:IQ:IMP 50
Initial S/W Revision:	Prior to A.02.00

Q Setup

Access the channel setup parameters for the Q channel.

Key Path	**Input/Output, I/Q**
Readback Text	When Q Same as I is On the readback is "Q Same as I".
Initial S/W Revision	Prior to A.02.00

Q Same as I

Many, but not all, usages require the I and Q channels have an identical setup. To simplify channel setup, the Q Same as I will cause the Q channel parameters to be mirrored from the I channel. That way your only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time Q Same as I is turned off the I and Q channel setups will be identical. This does not apply to Probe settings or to parameters that determined by the probe.

Remote Command	`:INPut:IQ:MIRRored OFF|ON|0|1` `:INPut:IQ:MIRRored?`
Example	Turn off the mirroring of parameters from I to Q. INP:IQ:MIRR OFF
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, Q Setup**
Couplings	Only displayed for the Q channel. When Yes, the I channel values for some parameters are mirrored (copied) to the Q channel. However, when a parameter is determined by the type of probe and a probe is sensed, the probe setting is always used and the I channel setting is ignored. The following parameters are mirrored: Differential Input (when not determined by probe) Input Z (when not determined by probe)
Preset	This is unaffected by a Preset but is set to the default value (Q Same as I set to "On") on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state.
Range	On | Off
Readback Text	"Q Same as I" when On, otherwise none.

Q Differential Input

Selects differential input on or off for the Q channel. For differential input (also called balanced input), the analyzer uses both the Q and Q-bar ports. When differential input is off (also called single-ended or unbalanced input), the analyzer uses only the Q port.

Remote Command	`:INPut:IQ:Q:DIFFerential OFF|ON|0|1` `:INPut:IQ:Q:DIFFerential?`
Example	Put the Q channel in Differential Input mode INP:IQ:Q:DIFF ON
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, Q Setup**
Notes	When Differential Input = On, the analyzer will check for attenuation mismatches between the Q and Q-bar ports. If the difference in attenuation values exceeds 0.5 dB an error condition will be set.

Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Analyzer will use only the main port and the key will show that the Analyzer's Differential Input mode is Off (indicating that the complementary port not in use). When a differential probe is not sensed and Q Same as I is On, the value set for I will be copied to Q. This key is disabled when Q Same as I is On.
Preset	Off
State Saved	On This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	Off | On

Q Input Z

Selects the input impedance for the Q channel. The impedance applies to both the Q and Q-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Remote Command	`:INPut[1]:IQ:Q:IMPedance LOW|HIGH`
	
	`:INPut[1]:IQ:Q:IMPedance?`

Example	Set the Q channel input impedance to 1 MΩ INP:IQ:Q:IMP HIGH
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, Q Setup**
Notes	LOW = 50 Ω, HIGH = 1 MΩ
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled and the value is set to match the probe. When no probe is sensed and Q Same as I is On, the value set for I will also be copied to Q. This key is disabled when Q Same as I is On.
Preset	LOW
State Saved	On This is unaffected by Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	50 Ω | 1 MΩ

Q Skew

Sets the skew factor for the Q channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling and probes.

Key Path	**Input/Output, I/Q, Q Setup**
Remote Command	`[:SENSe]:CORRection:IQ:Q:SKEW <seconds>` `[:SENSe]:CORRection:IQ:Q:SKEW?`
Preset	0
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	0 s to 100 ns
Example	Delay the data for the Q channel by 10 ns. CORR:IQ:Q:SKEW 10 ns
Initial S/W Revision	Prior to A.02.00

Q Probe

Accesses the probe setup parameters for the Q channel. See"I/Q Probe Setup" on page 56.

Key Path	**Input/Output, I/Q, Q Setup**
State Saved	No
Readback Text	[<Q port probe id>] This is reporting the type of probe sensed on the Q port. There is no parameter for overriding what is sensed.
Initial S/W Revision	Prior to A.02.00

I/Q Probe Setup

The set of I/Q probe setup parameters will change based on the type of probe that is sensed. All probe types have the Attenuation parameter, and all probe types can be calibrated. The remaining parameters are only available for some probe types and will not be shown when not available. The probe type is determined by and reported for only for the I and Q ports, never the I-bar or Q-bar ports. The menu title will be "<ch>: <probe id>", where "<ch>" is either "I" or "Q" and "<probe id>" is the type of probe. For example, for the I Probe setup with an Agilent 1130A probe connected to the I port, the title will be "I: 1130A".

Probe calibration data is stored for each probe type for each channel. When no probe is sensed, the probe type "Unknown" is used, and this is also treated like a probe type with its own calibration data. When a probe is changed, the calibration data for that probe type for that port is restored. An advisory message will be displayed showing the new probe type and the calibration status. The calibration data is stored permanently (survives a power cycle) and is not affected by a Preset or any of the Restore commands. When the probe has EEPROM identification (most newer Agilent probes have this), the calibration data is stored by probe serial number and port, so if you have two probes of the same type, the correct calibration data will be used for each. For probes that do not have EEPROM identification, the calibration data is stored by probe type and port and the instrument cannot distinguish between different probes of the same type. In all cases (with or without EEPROM identification), the calibration data is port specific, so it will not follow a specific probe from port to port if the probe is moved.

The "Unknown" probe type is used whenever no probe is sensed. When no calibration data exists for "Unknown" the latest cable calibration data is used (see Section “I/Q Guided Calibration” on page 101).

Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

Remote Command	`[:SENSe]:CORRection:IQ:I|Q:ATTenuation:RATio <real>` `[:SENSe]:CORRection:IQ:I|Q:ATTenuation:RATio?`
Example	Set the attenuation for the current I probe to 100.00:1. CORR:IQ:I:ATT:RAT 100
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe**
Notes	Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged.
Preset	Each probe type has its own default. The default for the "Unknown" probe type is 1:1.
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore.
Range	0.001 to 10000

Remote Command:	`[:SENSe]:CORRection:IQ:I|Q:ATTenuation <rel_ampl>` `[:SENSe]:CORRection:IQ:I|Q:ATTenuation?`
Range:	–60 dB to +80 dB
Example:	Set the attenuation for the current I probe type to 100.00:1. CORR:IQ:I:ATT 20 dB
Initial S/W Revision:	Prior to A.02.00

Offset

Some active probes have DC offset capability. When one of these probes is connected this control will be visible. The signal is adjusted for the DC offset before entering the analyzer's port. This allows for removal of a DC offset before hitting the analyzer's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the analyzer's max input voltage would exceed the input limits of the analyzer for half its cycle.

Removing the DC offset allows the analyzer to correctly process the entire signal.

Remote Command	`:INPut:OFFSet:I|Q <voltage>` `:INPut:OFFSet:I|Q?`
Example	Remove a DC offset of –0.5 V from the I channel input. INP:OFF:I –0.5
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe**
Notes	Only some probe types support Offset. For those that do, each probe type has its own Offset setting. As probes are changed the Offset value will reflect the new probe's setting. Changing the Offset affects only the current probe type's setting and leaves all others unchanged.
Preset	0 V
State Saved	Saved with probe calibration data. It survives power cycle and is not affected by Preset or Restore.
Range	–18 V to +18 V

Coupling

Some probe types allow coupling to reject low frequencies. This will filter out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

Remote Command	`:INPut:COUPling:I|Q DC|LFR1|LFR2` `:INPut:COUPling:I|Q?`
Example	Set the probe to low frequency rejection below 1.7 Hz. INP:COUP:I LFR1
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe**
Notes	Only some probe types support Coupling. For those that do, each probe type has its own Coupling setting. As probes are changed the Coupling value will reflect the new probe's setting. Changing the Coupling affects only the current probe type's setting and leaves all others unchanged.
Preset	DC
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore.
Range	DC | AC 1.7 Hz LFR1 | AC 0.14 Hz LFR2
Readback Text	DC | LFR1 | LFR2

DC

Turns off low frequency rejection, allowing signals down to DC.

Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe, Coupling**
Example	Turn off low frequency rejection on the I channel INP:COUP:I DC
Initial S/W Revision	Prior to A.02.00

LFR1

Turns on low frequency rejection, rejecting signal component lower than 1.7 Hz.

Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe, Coupling**
Example	Turn on low frequency rejection on the I channel for frequencies lower than 1.7 Hz INP:COUP:I LFR1
Initial S/W Revision	Prior to A.02.00

LFR2

Turns on low frequency rejection, rejecting signal component lower than 0.14 Hz.

Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe, Coupling**
Example	Turn on low frequency rejection on the I channel for frequencies lower than 0.14 Hz INP:COUP:I LFR2
Initial S/W Revision	Prior to A.02.00

Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When Differential Input is on, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When Differential Input is off, only the probe attached to the main port is calibrated. See “I/Q Guided Calibration” on page 101.

Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe, Coupling**
Readback Text	The last calibration date, or if no calibration exists, "(empty)". Last: <cal date> <cal time> Example: Last: 8/22/2007 1:02:49 PM

Initial S/W Revision	Prior to A.02.00

Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

Key Path	**Input/Output, I/Q, I Setup | Q Setup, I Probe | Q Probe**
Remote Command	`:CALibration:IQ:PROBe:I|Q:CLEar`
Example	Clear the calibration data for the I channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification). :CAL:IQ:PROBe:I:CLE
Initial S/W Revision	Prior to A.02.00

Reference Z

Sets the value of the impedance to be used in converting voltage to power for the I and Q channels. This does not change the hardware's path impedance (see “I Input Z” on page 51).

Key Path	**Input/Output, I/Q**
Remote Command	`:INPut:IMPedance:REFerence <integer>` `:INPut:IMPedance:REFerence?`
Preset	50 Ω
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	1 Ω to 1 MΩ
Example	Set the I/Q reference impedance to 50 Ω INP:IMP:REF 50
Initial S/W Revision	Prior to A.02.00

I/Q Cable Calibrate…

Invokes the guided cable calibration. The guided cable calibration steps the user through a calibration of all ports (I, I-bar, Q, and Q-bar) using just a cable (no probe attached). See “I/Q Guided Calibration” on page 101.

Key Path	**Input/Output, I/Q**
Initial S/W Revision	Prior to A.02.00

RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator "off" (switches back to the selected input). When one of the calibrator signals is selected, the analyzer routes that signal (an internal amplitude reference) to the analyzer, while leaving the main input selection (RF or I/Q) unchanged.

This function presets to OFF on a Mode Preset, which causes the internal circuitry to switch back to the selected input (RF or I/Q).

Remote Command:	`[:SENSe]:FEED:AREFerence REF50|REF4800|OFF` `[:SENSe]:FEED:AREFerence?`
Example:	FEED:AREF REF50 !selects the 50 MHz amplitude reference as the signal input. FEED:AREF REF4800 !selects the 4.8 GHz amplitude reference as the signal input FEED:AREF OFF !turns the calibrator "off" (switches back to the selected input – RF or I/Q)
Dependencies:	Selecting an input (RF or I/Q) turns the Calibrator OFF. This is true whether the input is selected by the keys or with the [:SENSe]:FEED command. The 4.8 GHz internal reference is only available in some models and frequency range options. If the 4.8 GHz reference is not present, the **4.8 GHz** softkey will be blanked, and if the REF4800 parameter is sent, the analyzer will generate an error.
Preset:	OFF
State Saved:	Saved in State
Key Path:	**Input/Output**
Readback:	Off, 50 MHz, 4.8 GHz
Backwards Compatibility SCPI:	For ESA backwards compatibility, the legacy SCPI command CALibration:SOURce:STATe <boolean> (ESA's Amptd Ref Out SCPI) will still be supported and mapped as follows: When CALibration:SOURce:STATe ON is received [SENSe]:FEED:AREF REF50 will execute When CALibration:SOURce:STATe OFF is received [SENSe]:FEED:AREF OFF will execute When CALibration:SOURce:STATe? is received, 1 will be returned if any of the references is selected and 0 if the Calibrator is "Off"
Initial S/W Revision:	Prior to A.02.00

50 MHz

Selects the 50 MHz internal reference as the input signal.

Example:	:FEED:AREF REF50
Key Path:	**Input/Output, RF Calibrator**
Readback:	50 MHz
Initial S/W Revision:	Prior to A.02.00

4.8 GHz

Selects the 4.8 GHz internal reference as the input signal.

Example:	:FEED:AREF REF4800
Key Path:	**Input/Output, RF Calibrator**
Readback:	4.8 GHz
Dependencies:	The 4.8 GHz internal reference is only available in some models and frequency range options. If the 4.8 GHz reference is not present, the **4.8 GHz** softkey will be blanked, and if the REF4800 parameter is sent, the analyzer will generate an error.
Initial S/W Revision:	Prior to A.02.00
Modified at S/W Revision:	A.03.00

Off

Switches the input back to the selected input (RF or I/Q)

Example:	:FEED:AREF OFF
Key Path:	**Input/Output, RF Calibrator**
Readback:	Off
Initial S/W Revision:	Prior to A.02.00

External Gain

Compensates for gain or loss in the measurement system outside the spectrum analyzer. The External Gain is subtracted from the amplitude readout (or the loss is added to the amplitude readout). So, the displayed signal level represents the signal level at the output of the device-under-test, which can be the input of an external device that provides gain or loss.

Entering an External Gain value does not affect the Reference Level, therefore the trace position on screen changes, as do all of values represented by the trace data. Thus, the values of exported trace data, queried trace data, marker amplitudes, trace data used in calculations such as N dB points, trace math, peak threshold, etc., are all affected by External Gain. Changing the External Gain, even on a trace which is not updating, will immediately change all of the above, without new data needing to be taken.

NOTE	Changing the External Gain causes the analyzer to immediately stop the current sweep and prepare to begin a new sweep, but the data will not change until the trace data updates, because the offset is applied to the data as it is taken. If a trace is exported with a nonzero External Gain, the exported data will contain the trace data with the offset applied.

In the Spectrum Analyzer mode, a Preamp is the common external device providing gain or loss. In a measurement application mode like GSM or W-CDMA, the gain or loss could be from a BTS (Base Transceiver Station) or an MS (Mobile Station). So in the Spectrum Analyzer mode MS and BTS would be grayed out and the only choice would be Ext Preamp. Similarly in some of the digital communications applications, Ext Preamp will be grayed out and you would have a choice of MS or BTS.

Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output**
Couplings	The Ext Preamp, MS, and BS keys may be grayed out depending on which measurement is currently selected. If any of the grayed out keys are pressed, or the equivalent SCPI command is sent, an advisory message is generated.
Readback	1-of-N selection | [variable]

Ext Preamp

This function is similar to the reference level offset function. Both affect the displayed signal level. Ref Lvl Offset is a mathematical offset only, no analyzer configuration is affected. Ext Preamp gain is used when determining the auto-coupled value of the Attenuator. The External Gain value and the Maximum Mixer Level settings are both part of the automatic setting equation for the RF attenuation setting. (10 dB of Attenuation is added for every 10 dB of External Gain.)

Note that the Ref Lvl Offset and Maximum Mixer Level are described in the Amplitude section. They are reset by the instrument Preset. The External Preamp Gain is reset by the "Restore Input/Output Defaults" or "Restore System Defaults->All functions. . The External Gain is subtracted from the amplitude readout so that the displayed signal level represents the signal level at the output of the device-under-test, which is the input of the external device that is providing gain or loss.

Remote Command:	`[:SENSe]:CORRection:SA[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:SA[:RF]:GAIN?`
Example:	CORR:SA:GAIN 10 !sets the Ext Gain value to 10 dB CORR:SA:GAIN –10 !sets the Ext Gain value to –10 dB (that is, an attenuation of 10 dB)
Notes:	Does not auto return.

Dependencies:	The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, and RF Atten. This key is grayed out in Modes that do not support External Gain
Preset:	This is unaffected by Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved:	Saved in instrument state
Min:	–81.90 dB
Max:	81.90 dB
Key Path:	**Input/Output, External Gain**
Readback:	Preamp Gain, <Ext Gain value> dB
Backwards Compatibility SCPI:	[:SENSe]:CORRection:OFFSet[:MAGNitude]
Initial S/W Revision:	Prior to A.02.00

MS

Sets an external gain/attenuation value for MS (Mobile Station) tests.

Remote Command:	`[:SENSe]:CORRection:MS[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:MS[:RF]:GAIN?`
Example:	CORR:MS:GAIN 10 !sets the Ext Gain value to 10 dB CORR:MS:GAIN –10 !sets the Ext Gain value to –10 dB (that is, a loss of 10 dB.)
Notes:	Does not auto return.
Dependencies:	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support MS.
Preset:	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved:	Saved in instrument state.
Min:	–100 dB
Max:	100 dB
Key Path:	**Input/Output, External Gain**
Readback:	MS, <Ext Gain value> dB

Backwards Compatibility SCPI:	[:SENSe]:CORRection:MS[:RF]:LOSS
Backwards Compatibility SCPI:	[:SENSe]:CORRection:MS[:RF]:LOSS <rel_ampl> [:SENSe]:CORRection:MS[:RF]:LOSS? Important notes regarding the alias commands: A positive value of <rel_ampl> in the above command means a loss and a negative value indicates a gain. So, for example, sending the command a) CORR:MS:LOSS 10 dB will set the value on the softkey and the active function to –10 dB since the softkey and the active function always show the Gain. The query CORR:MS:LOSS? returns 10 dB The query CORR:MS:GAIN? returns –10 dB b) CORR:MS:LOSS –10 dB will set the value on the softkey and the active function to 10 dB since the softkey and the active function always show the Gain The query CORR:MS:LOSS? returns –10 dB The query CORR:MS:GAIN? returns 10 dB
Initial S/W Revision:	Prior to A.02.00

BTS

Sets an external attenuation value for BTS (Base Transceiver Station) tests.

Remote Command:	`[:SENSe]:CORRection:BTS[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:BTS[:RF]:GAIN?`
Example:	CORR:BTS:GAIN 10 !sets the Ext Gain value to 10 dB CORR:BTS:GAIN –10 !sets the Ext Gain value to –10 dB (that is, a loss of 10 dB.)
Notes:	Does not auto return.
Dependencies:	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support BTS.
Preset:	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved:	Saved in instrument state.
Min:	–100 dB
Max:	100 dB
Key Path:	**Input/Output, External Gain**

Readback:	BTS, <Ext Gain value> dB
Backwards Compatibility SCPI:	[:SENSe]:CORRection:BTS[:RF]:LOSS
Backwards Compatibility SCPI:	[:SENSe]:CORRection:BTS[:RF]:LOSS <rel_ampl> [:SENSe]:CORRection:BTS[:RF]:LOSS? Important notes regarding the alias commands: A positive value of <rel_ampl> in the above command means a loss and a negative value indicates a gain. So, for example, sending the command a) CORR:BTS:LOSS 10 dB will set the value on the softkey and the active function to –10 dB since the softkey and the active function always show the Gain. The query CORR:BTS:LOSS? returns 10 dB The query CORR:BTS:GAIN? returns –10 dB b) CORR:BTS:LOSS –10 dB will set the value on the softkey and the active function to 10 dB since the softkey and the active function always show the Gain The query CORR:BTS:LOSS? returns –10 dB The query CORR:BTS:GAIN? returns 10 dB
Initial S/W Revision:	Prior to A.02.00

I Ext Gain

This function affects only the I channel input, except when the Input Path is I+jQ. In I+jQ this setting is applied to both I and Q channel inputs. It is not available unless the Baseband I/Q option (BBA) is installed.

Remote Command	`[:SENSe]:CORRection:IQ:I:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:I:GAIN?`
Example	Set the I Ext Gain to 10 dB CORR:IQ:I:GAIN 10 Set the I Ext Gain to –10 dB (that is, a loss of 10 dB.) CORR:IQ:I:GAIN –10
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, External Gain**
Notes	Not available unless option BBA is installed
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

State Saved	Saved in instrument state.
Min	–100 dB
Max	100 dB
Readback Text	I Gain, <I Ext Gain> dB

Q Ext Gain

This function affects only the Q channel input and only when the Input Path is not I+jQ. It is not available unless the Baseband I/Q option (BBA) is installed.

Remote Command	`[:SENSe]:CORRection:IQ:Q:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:Q:GAIN?`
Example	Set the Q Ext Gain to 10 dB CORR:IQ:Q:GAIN 10 Set the Q Ext Gain to –10 dB (that is, a loss of 10 dB.) CORR:IQ:Q:GAIN –10
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, External Gain**
Notes	Not available unless option BBA is installed.
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state.
Min	–100 dB
Max	100 dB
Readback Text	Q Gain, <I Ext Gain> dB

Restore Input/Output Defaults

This selection causes the group of settings and data associated with the **Input/Output** key to be a reset to their default values. This level of Restore System Defaults does not affect any other system settings or mode settings and does not cause a mode switch. All the features described in this section are reset using this key, including Input Corrections and Data (described in the Corrections section).

Example:	:SYST:DEF INP !presets all the Input/Output variables to their factory default values.
Notes:	Please refer to the Utility Functions for information about Restore System Defaults and the complete description of the :SYSTem:DEFault INPut: command.

Key Path:	**Input/Output**
Initial S/W Revision:	Prior to A.02.00

Data Source

Gives you the choice of either using a hardware input signal as the input or raw data stored in a data storage buffer from an earlier acquisition. You can also share raw data across certain measurements that support this feature. The measurements must be capable of storing raw data. There are three choices under this menu. You can select "Inputs" which is the same as selecting one of the inputs from the input port, for example RF, AREF, I/Q, or IFALign. Selecting "Capture Buffer" allows you to use data that has been stored earlier in the same measurement or from a previous measurement using the "Current Meas -> Capture Buffer" feature. Selecting "Recorded Data" allows you to playback long data capture records stored in the record buffer.

When you make a recording (see "Record Data Now" on page 70) or when you recall a recording (see the Recall section) the data source is automatically set to Recorded Data. You can toggle the data source between Inputs and the current Recording (if there is one). That is, the recording remains in memory until it is replaced by a new recording, or the application is closed.

Remote Command:	`[:SENSe]:FEED:DATA INPut|STORed|RECorded` `[:SENSe]:FEED:DATA?`
Example:	FEED:DATA REC FEED:DATA?
Dependencies:	Not all inputs are available in all modes. Unavailable keys are grayed out.
Notes:	INPuts = Inputs STORed = Capture Buffer RECorded = Record Data Buffer
Preset:	This is unaffected by Preset but is set to INPut on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved:	Saved in state
Key Path:	**Input/Output**
Readback:	Variable

Backwards Compatibility SCPI:	[:SENSe]:FEED:SOURce INPut|STORed [:SENSe]:FEED:SOURce?
Initial S/W Revision:	Prior to A.02.00

Inputs

Sets the measurement to use the input selections (RF, AREF, I/Q)

Example:	FEED:DATA INP !causes the measurement to look at the input selection
Notes:	Does not auto return.
Key Path:	**Input/Output, Data Source**
Readback:	Inputs
Initial S/W Revision:	Prior to A.02.00

Capture Buffer

Some WCDMA and demod measurements support this feature. This allows sharing of the raw data across certain measurements. If you want to make another measurement on the same signal, you would store that raw data using the "Current Meas -> Capture Buffer" key. Then the data is available for the next measurement to use. You must have raw data stored in the instrument memory before the Capture Buffer choice is available for use.

If you switch to a measurement that does not support this feature, then the instrument switches to use "Inputs" and grays out this key. If the grayed out key is pressed, it generates a message.

Example:	FEED:DATA STOR !causes stored measurement data to be used with a different measurement that supports this.
Notes:	Does not auto return. This key is grayed out when you switch to a measurement that does not support this feature.
Dependencies:	Grayed out in the SA measurement.
Key Path:	**Input/Output, Data Source**
Readback:	Stored Data
Initial S/W Revision:	Prior to A.02.00

Recorded Data

Directs the instrument to get data from the record data buffer in the measurement, rather than from the RF Input Signal.

Example:	FEED:DATA REC !causes the measurement to extract data from the record data buffer.
Notes:	Does not auto return.

Dependencies:	Grayed out in the SA measurement.
Key Path:	**Input/Output, Data Source**
Readback:	Recorded Data
Initial S/W Revision:	Prior to A.02.00

Current Meas -> Capture Buffer

Pressing this key stores the raw data of one measurement in the internal memory of the instrument where it can then be used by a different measurement by pressing "Stored Data". When raw data is stored, then the data source selection switch automatically changes to "Stored Data". Stored raw data cannot be directly accessed by a user. There is no save/recall function to save the raw data in an external media. However if you want to get the stored raw data, you must first perform a measurement using the stored raw data. Now you can access the used raw data, which is the same as stored raw data, using the FETch or READ commands.

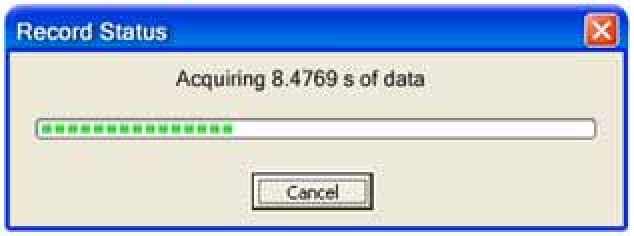
Remote Command:	`[:SENSe]:FEED:DATA:STORe`
Example:	FEED:DATA:STOR !stores recorded data
Dependencies:	Grayed out in the SA measurement.
Notes:	This is command only, there is no query
Key Path:	**Input/Output, Data Source**
Backwards Compatibility SCPI:	[:SENSe]:FEED:SOURce:STORe
Initial S/W Revision:	Prior to A.02.00

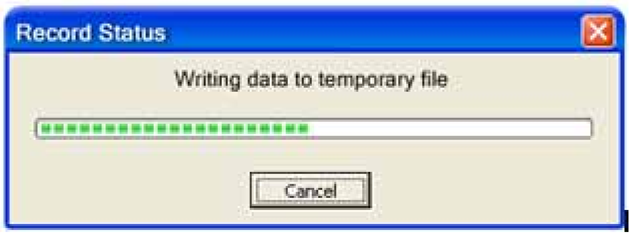
Record Data Now

This causes the data source to change to Inputs (if it is not already set) and a recording is made with the current instrument setup. The length of the recording must be specified in advance.

This key changes to **Abort Recording** once the recording process has started. It changes back when the recording is complete.

The following dialogs show the progress of the recording:





This key is also available in the Sweep/Control menu.

Remote Command	`[:SENSe]:RECording:INITiate[:IMMediate]`
Example	REC:INIT
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, Data Source**
Mode	VSA
Notes	This is command only, there is no query. See the Recall functionality to access previously saved data.
Dependencies	Grayed out in the SA measurement.
Couplings	Changes Data source to Recorded Data.

Remote Command:	`[:SENSe]:RECording:ABORt`
Example:	REC:ABOR
Key Path:	**Input/Output, Data Source**
Notes:	This is command only, there is no query. The command does nothing if it is sent when there is no recording in progress.
Initial S/W Revision:	Prior to A.02.00

Record Length

This specifies the length of the next recording. (You cannot use this to modify the length of the current recording.) The length defaults to seconds, but you can also specify it in points at the current sample rate, or in time records at the current time record length.

Remote Command	`[:SENSe]:RECording:LENGth <real>,SEConds|RECords|POINts`
	`[:SENSe]:RECording:LENGth:STATe MAX|MANual`
	`[:SENSe]:RECording:LENGth:STATe?`

Example	REC:LENG 20,REC REC:LENG 4.1E–4,SEC REC:LENG:STAT MAX REC:LENG:STAT?
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, Data Source**
Mode	VSA
Notes	There is no default unit. The unit must be specified. The length command does not have a query form. Length information is queried using the two commands following this table. If set to MAX, all of the available "recording memory" us used.
Preset	50 Records, Manual
State Saved	No
Min	0
Max	Depends on memory available.
Readback	<value><Seconds|Points|Records>

Remote Command	`[:SENSe]:RECording:LENGth:VALue?`
Example	REC:LENG:VAL?
Initial S/W Revision	Prior to A.02.00
Mode	VSA
Notes	Query Only Returns the first (numeric) parameter of the most recent [:SENSe]:RECording:LENGth command.
Preset	50 Records

Remote Command	`[:SENSe]:RECording:LENGth:UNIT?`
Example	REC:LENG:UNIT?
Initial S/W Revision	Prior to A.02.00

Mode	VSA
Notes	Query Only Returns the second parameter of the most recent [:SENSe]:RECording:LENGth command. Possible values are SEC|REC|POIN. If no second parameter was sent, then the return value is SEC.
Preset	RECords

Corrections

This key accesses the Amplitude Corrections menu.

Amplitude Corrections arrays can be entered, sent over SCPI, or loaded from a file. They allow you to correct the response of the analyzer for various use cases. The X-series supports four separate Corrections arrays, each of which can contain up to 2000 points. They can be turned on and off individually and any or all can be on at the same time.

Trace data is in absolute units and corrections data is in relative units, but we want to be able to display trace data at the same time as corrections data. Therefore we establish a reference line to be used while building or editing a Corrections table. The reference line is halfway up the display and represents 0 dB of correction. It is labeled “0 dB CORREC”. It is drawn in blue.

Corrections data is always in dB. Whatever dB value appears in the correction table represents the correction to be applied to that trace at that frequency. So if a table entry shows 30 dB that means we ADD 30 dB to each trace to correct it before displaying it.

In zero span, where the frequency is always the center frequency of the analyzer, we apply the (interpolated) correction for the center frequency to all points in the trace. In the event where there are two correction amplitudes at the center frequency, we apply the first one in the table.

Note that the corrections are applied as the data is taken; therefore, a trace in **View** (Update Off) will not be affected by changes made to the corrections table after the trace is put in **View**.

Initial S/W Revision	A.02.00
Key Path	**Input/Output, Corrections**
Mode	SA, DVB-T/H, DTMB, SEQAN
Dependencies	This key will only appear if you have the proper option installed in your instrument. Amplitude correction may not be available in all modes; if a mode does not support amplitude correction, the Corrections key should be blanked while in that mode. If an application supports corrections but the current measurement does not, then the key should be grayed out in that measurement
Preset	Corrections arrays are reset (deleted) by Restore Input/Output Defaults. They survive shutdown and restarting of the analyzer application, which means they will survive a power cycle.

Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Initial S/W Revision	A.02.00
Key Path	**Input/Output, Corrections**
Mode	SA
Notes	The selected correction is remembered even when not in the correction menu.
Preset	Set to Correction 1 by Restore Input/Output Defaults
Readback	Correction 1|Correction 2|Correction 3|Correction 4|Correction 5|Correction 6

Correction On/Off

Turning the Selected Correction on allows the values in it to be applied to the data. This also automatically turns on "Apply Corrections" (sets it to ON), otherwise the correction would not take effect.

A new sweep is initiated if an amplitude correction is switched on or off. Note that changing, sending or loading corrections data does NOT directly initiate a sweep, however in general these operations will turn corrections on, which DOES initiate a sweep.

Remote Command:	`[:SENSe]:CORRection:CSET[1]|2|3|4|5|6[:STATe] ON|OFF|1|0` `[:SENSe]:CORRection:CSET[1]|2|3|4|5|6[:STATe]?`
Example:	SENS:CORR:CSET1 ON
Dependencies:	Turning this on automatically turns on "Apply Corrections" Only the first correction array (Correction 1) supports antenna units. When this array is turned on, and it contains an Antenna Unit other than “None”, the Y Axis Unit of the analyzer is forced to that Antenna Unit. All other Y Axis Unit choices are grayed out. Note that this means that a correction file with an Antenna Unit can only be loaded into the Corrections 1 register. Consequently only for Correction 1 does the dropdown in the Recall dialog include.ant, and if an attempt is made to load a correction file into any other Correction register which DOES contain an antenna unit, a Mass Storage error is generated. This command will generate an “Option not available” error unless you have the proper option installed in your instrument.
Preset:	Not affected by a Preset. Set to OFF by **Restore Input/Output Defaults**
State Saved:	Saved in instrument state.
Key Path:	**Input/Output, Corrections**

Initial S/W Revision:	A.02.00

Properties

Accesses a menu that lets you set the properties of the selected correction.

Key Path	**Input/Output, Corrections**
Initial S/W Revision	A.02.00

Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Initial S/W Revision	A.02.00
Key Path	**Input/Output, Corrections, Properties**
Notes	The selected correction is remembered even when not in the correction menu.
Preset	Set to Correction 1 by Restore Input/Output Defaults.
Readback	Correction 1|Correction 2|Correction 3|Correction 4|Correction 5|Correction 6

Antenna Unit

For devices (like antennae) which make measurements of field strength or flux density, the correction array should contain within its values the appropriate conversion factors such that, when the data on the analyzer is presented in dBµV, the display is calibrated in the appropriate units. The "Antenna Unit" used for the conversion is contained within the corrections array database. It may be specified by the user or loaded in from an external file or SCPI.

When an array with an Antenna Unit other than "None" is turned on, the Y Axis Unit of the analyzer is forced to that unit. When this array is turned on, and it contains an Antenna Unit other than “None”, the Y Axis Unit of the analyzer is forced to that Antenna Unit., and all other Y Axis Unit choices are grayed out.

Antenna Unit does not appear in all Modes that support Corrections. Only the modes listed in the Mode row of the table below support Antenna Units.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|3|4:ANTenna[:UNIT] GAUSs|PTESla|UVM|UAM|NOConversion` `[:SENSe]:CORRection:CSET[1]|2|3|4:ANTenna[:UNIT]?`
Example	CORR:CSET:ANT GAUS
Initial S/W Revision	A.02.00
Key Path	**Input/Output, Corrections, Properties**
Mode	SA

Dependencies	Only the first correction array (Correction 1) supports antenna units. Note that this means that a correction file with an Antenna Unit can only be loaded into the Corrections 1 register. Consequently only for Correction 1 does the dropdown in the Recall dialog include.ant, and if an attempt is made to load a correction file into any other Correction register which DOES contain an antenna unit, a Mass Storage error is generated.
Preset	Unaffected by Preset. Set to NOC by Restore Input/Output Defaults
State Saved	Saved in State

dBµV/m

Sets the antenna unit to dBµV/m. If this correction is turned on, and Apply Corrections is on, the Y Axis Unit will then be forced to dBµV/m and all other Y Axis Unit selections will be grayed out.

Example:	:CORR:CSET2:ANT UVM
Key Path:	**Input/Output, Corrections, Properties, Antenna Unit**
Readback:	"dBµV/m"
Initial S/W Revision:	A.02.00

dBµA/m

Sets the antenna unit to dBµA/m. If this correction is turned on, and Apply Corrections is on, the Y Axis Unit will then be forced to dBµA/m and all other Y Axis Unit selections will be grayed out.

Example:	:CORR:CSET2:ANT UVA
Key Path:	**Input/Output, Corrections, Properties, Antenna Unit**
Readback:	" dBµA/m"
Initial S/W Revision:	A.02.00

dBpT

Sets the antenna unit to dBpT. If this correction is turned on, and Apply Corrections is on, the Y Axis Unit will then be forced to dBpT and all other Y Axis Unit selections will be grayed out.

Example:	:CORR:CSET3:ANT PTES
Key Path:	**Input/Output, Corrections, Properties, Antenna Unit**
Readback:	"dBpT"
Initial S/W Revision:	A.02.00

dBG

Sets the antenna unit to dBG. If this correction is turned on, and Apply Corrections is on, the Y Axis Unit will then be forced to dBG and all other Y Axis Unit selections will be grayed out.

Example:	:CORR:CSET:ANT GAUS
Key Path:	**Input/Output, Corrections, Properties, Antenna Unit**
Readback:	" dBG"
Initial S/W Revision:	A.02.00

None

Selects no antenna unit for this Correction set. Thus no Y Axis unit will be forced.

Example:	:CORR:CSET4:ANT NOC
Key Path:	**Input/Output, Corrections, Properties, Antenna Unit**
Readback:	"None"
Initial S/W Revision:	A.02.00

Frequency Interpolation

This setting controls how the correction values per-bucket are calculated. We interpolate between frequencies in either the logarithmic or linear scale.

This setting is handled and stored individually per correction set.

See "Interpolation" on page 77

Remote Command:	`[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:X:SPACing LINear|LOGarithmic` `[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:X:SPACing?`
Example:	CORR:CSET:X:SPAC LIN
Preset:	Unaffected by a Preset. Set to Linear by Restore Input/Output Defaults.
State Saved:	Saved in instrument state.
Key Path:	**Input/Output, Corrections, Properties**
Initial S/W Revision:	A.02.00

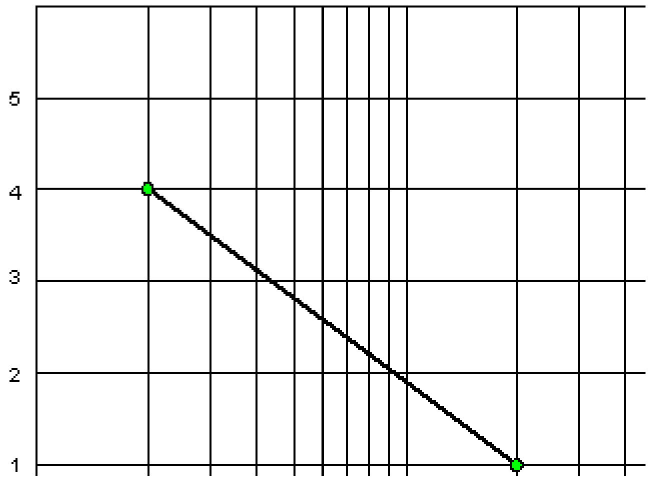
Interpolation

For each bucket processed by the application, all of the correction factors at the frequency of interest (center frequency of each bucket) are summed and added to the amplitude. All trace operations and post processing treat this post-summation value as the true signal to use.

To effect this correction, the goal, for any particular start and stop frequency, is to build a correction trace, whose number of points matches the current Sweep Points setting of the instrument, which will be used to apply corrections on a bucket by bucket basis to the data traces.

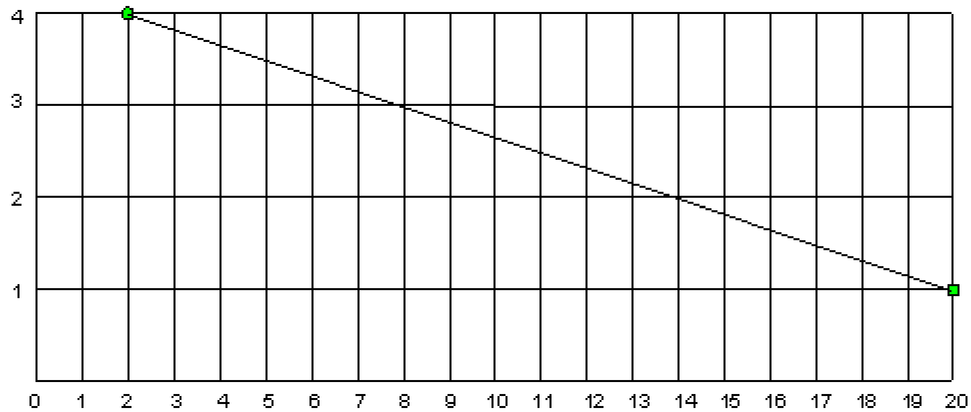
For amplitudes that lie between two user specified frequency points, we interpolate to determine the amplitude value. You may select either linear or logarithmic interpolation between the frequencies.

If we interpolate on a log scale, we assume that the line between the two points is a straight line on the log scale. For example, let's say the two points are (2,4) and (20,1). A straight line between them on a log scale looks like:



On a linear scale (like that of the spectrum analyzer), this translates to:

On the other hand, if we interpolate on a linear scale, we assume that the two points are connected by a straight line on the linear scale, as below:



The correction to be used for each bucket is taken from the interpolated correction curve at the center of the bucket.

Description

Sets an ASCII description field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen dump.

Remote Command:	`[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DESCription "text"` `[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DESCription?`
Example:	:CORR:CSET1:DESC "11941A Antenna correction"
Notes:	45 chars max; may not fit on display if max chars used
Preset:	Unaffected by a Preset. Set to empty by **Restore Input/Output Defaults**
State Saved:	Saved in instrument state.
Key Path:	**Input/Output, Corrections, Properties**
Initial S/W Revision:	A.02.00

Comment

Sets an ASCII comment field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen dump.

Remote Command:	`[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:COMMent "text"` `[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:COMMent?`
Example:	:CORR:CSET1:COMM "this is a comment"
Notes:	45 chars max; may not fit on display if max chars used
Preset:	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**

State Saved:	Saved in State
Key Path:	**Input/Output, Corrections, Properties**
Initial S/W Revision:	A.02.00

Edit

Invokes the integrated editing facility for this correction set.

When entering the menu, the editor window turns on, the selected correction is turned **On**, **Apply Corrections** is set to **On**, the amplitude scale is set to **Log**, and the Amplitude Correction (“Ampcor”) trace is displayed. The actual, interpolated correction trace is shown in green for the selected correction. Note that since the actual interpolated correction is shown, the correction trace may have some curvature to it. This trace represents only the correction currently being edited, rather than the total, accumulated amplitude correction for all amplitude corrections which are currently on, although the total, accumulated correction for all corrections which are turned on is still applied to the data traces.

Because corrections data is always in dB, but the Y-axis of the analyzer is in absolute units, it is necessary to establish a reference line for display of the Corrections data. The reference line is halfway up the display and represents 0 dB of correction. It is labeled “0 dB CORREC”. It is drawn in blue.

Corrections data is always in dB. Whatever dB value appears in the correction table represents the correction to be applied to that trace at that frequency. So if a table entry shows 30 dB that means we ADD 30 dB to each trace to correct it before displaying it. By definition all points are connected. If a gap is desired for corrections data, enter 0 dB.

Note that a well-designed Corrections array should start at 0 dB and end at 0 dB. This is because whatever the high end point is will be extended to the top frequency of the instrument, and whatever the low end point is will be extended down to 0 Hz. So for a Corrections array to have no effect outside its range, you should start and end the array at 0 dB.

NOTE	The table editor will only operate properly if the analyzer is sweeping, because its updates are tied to the sweep system. Thus, you should not try to use the editor in single sweep, and it will be sluggish during compute-intensive operations like narrow-span FFT sweeps.

When exiting the edit menu (by using the **Return** key or by pressing an instrument front-panel key), the editor window turns off and the Ampcor trace is no longer displayed; however, **Apply Corrections** remains **On**, any correction that was on while in the editor remains on, and the amplitude scale returns to its previous setting.

Corrections arrays are not affected by a Preset, because they are in the Input/Output system. They also survive shutdown and restarting of the analyzer application, which means they will survive a power cycle.

Key Path	**Input/Output, Corrections**
Initial S/W Revision	A.02.00

Navigate

Lets you move through the table to edit the desired point.

Initial S/W Revision	A.02.00
Key Path	**Input/Output, Corrections, Edit**
Notes	There is no value readback on the key
Min	1
Max	2000

Frequency

Lets you edit the frequency of the current row.

Initial S/W Revision	A.02.00
Key Path	**Input/Output, Corrections, Edit**
Notes	There is no value readback on the key.
Min	0
Max	1 THz

Amplitude

Lets you edit the Amplitude of the current row.

Initial S/W Revision	A.02.00
Key Path	**Input/Output, Corrections, Edit**
Notes	There is no value readback on the key.
Min	–1000 dB
Max	1000 dB

Insert Point Below

Inserts a point below the current point. The new point is a copy of the current point and becomes the current point. The new point is not yet entered into the underlying table, and the data in the row is displayed in light gray.

Key Path	**Input/Output, Corrections, Edit**
Initial S/W Revision	A.02.00

Delete Point

Deletes the currently-selected point, whether or not that point is being edited, and selects the Navigate functionality. The point following the currently-selected point (or the point preceding if there is none) will be selected.

Key Path	**Input/Output, Corrections, Edit**
Initial S/W Revision	A.02.00

Scale X Axis

Matches the X Axis to the selected Correction, as well as possible. Sets the Start and Stop Frequency to contain the minimum and maximum Frequency of the selected Correction. The range between Start Frequency and Stop Frequency is 12.5% above the range between the minimum and maximum Frequency, so that span exceeds this range by one graticule division on either side. If in zero-span, or there is no data in the Ampcor table, or the frequency range represented by the table is zero, no action is taken. Standard clipping rules apply if the value in the table is outside the allowable range for the X axis.

Key Path	**Input/Output, Corrections, Edit**
Initial S/W Revision	A.02.00

Delete Correction

Deletes the correction values for this set. When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete correction. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message “Correction deleted” appears in the MSG line.

Remote Command:	`[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DELete`
Example:	CORR:CSET:DEL CORR:CSET1:DEL CORR:CSET4:DEL
Notes:	Pressing this key when no corrections are present is accepted without error.
Key Path:	**Input/Output, Corrections**
Initial S/W Revision:	A.02.00

Apply Corrections

Applies amplitude corrections which are marked as ON to the measured data. If this is set to OFF, then no amplitude correction sets will be used, regardless of their individual on/off settings. If set to ON, the corrections that are marked as ON (see “Correction On/Off” on page 74) are used.

Remote Command:	`[:SENSe]:CORRection:CSET:ALL[:STATe] ON|OFF|1|0` `[:SENSe]:CORRection:CSET:ALL[:STATe]?`
Example:	SENS:CORR:CSET:ALL OFF This command makes sure that no amplitude corrections are applied, regardless of their individual on/off settings.

Preset:	Not affected by Preset. Set to OFF by Restore Input/Output Defaults
State Saved:	Saved in instrument state.
Key Path:	**Input/Output, Corrections**
Initial S/W Revision:	A.02.00

Delete All Corrections

Erases all correction values for all 4 Amplitude Correction sets.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete all corrections. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message “All Corrections deleted” appears in the MSG line.

Remote Command:	`[:SENSe]:CORRection:CSET:ALL:DELete`
Example:	CORR:CSET:ALL:DEL
Key Path:	**Input/Output, Corrections**
Initial S/W Revision:	A.02.00

Remote Correction Data Set Commands

Set (Replace) Data (Remote Command Only)

The command takes an ASCII series of alternating frequency and amplitude points, each value separated by commas.

The values sent in the command will totally replace all existing correction points in the specified set.

An Ampcor array can contain 2000 points maximum.

Remote Command:	`[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DATA <freq>, <ampl>, . . .` `[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DATA?`
Example:	CORR:CSET1:DATA 10000000,–1.0,20000000,1.0 This defines two correction points at (10 MHz, –1.0 dB) and (20 MHz, 1.0 dB) for correction set 1.
Preset:	Empty after Restore Input/Output Defaults. Survives a shutdown or restart of analyzer application (including a power cycle).
State Saved:	Saved in instrument state.
Min:	Freq: 0 Hz Amptd: –1000 dBm
Max:	Freq: 1 THz Amptd: +1000 dBm

Initial S/W Revision:	A.02.00

Merge Correction Data (Remote Command Only)

The command takes an ASCII series of alternating frequency and amplitude points, each value separated by commas. The difference between this command and Set Data is that this merges new correction points into an existing set.

Any new point with the same frequency as an existing correction point will replace the existing point's amplitude with that of the new point.

An Ampcor array can contain 2000 total points, maximum.

Remote Command:	`[:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DATA:MERGe <freq>, <ampl>, ...`
Example:	CORR:CSET1:DATA:MERGE 15000000,–5.0,25000000,5.0 This adds two correction points at (15 MHz, –5.0 dB) and (25 MHz, 5.0 dB) to whatever values already exist in correction set 1.
Preset:	Empty after Restore Input/Output Defaults. Survives shutdown/restart of analyzer application (including power cycle)
Min:	Freq: 0 Hz Amptd: –1000 dBm
Max:	Freq: 1 THz Amptd: +1000 dBm
Initial S/W Revision:	A.02.00

Freq Ref In

Specifies the frequency reference as being the internal reference, external reference or sensing the presence of an external reference.

When the frequency reference is set to internal, the internal 10 MHz reference is used even if an external reference is connected.

When the frequency reference is set to external, the instrument will use the external reference. However, if there is no external signal present, or it is not within the proper amplitude range, an error condition detected message is generated. When the external signal becomes valid, the error is cleared.

If Sense is selected, the instrument checks whether a signal is present at the external reference connector and will automatically switch to the external reference when a signal is detected. When no signal is present, it automatically switches to the internal reference. No message is generated as the reference switches between external and internal. The monitoring of the external reference occurs approximately on 1 millisecond intervals, and never occurs in the middle of a measurement acquisition, only at the end of the measurement (end of the request).

If for any reason the instrument's frequency reference is not able to obtain lock, Status bit 2 in the Questionable Frequency register will be true and an error condition detected message is generated. When lock is regained, Status bit 2 in the Questionable Frequency register will be cleared and an error message is cleared will be sent.

If an external frequency reference is being used, you must enter the frequency of the external reference if it is not exactly 10 MHz. The External Ref Freq key is provided for this purpose.

Remote Command:	`[:SENSe]:ROSCillator:SOURce:TYPE INTernal|EXTernal|SENSe` `[:SENSe]:ROSCillator:SOURce:TYPE?`
Preset:	This is unaffected by a Preset but is set to SENSe on a "Restore Input/Output Defaults" or "Restore System Defaults->All".
State Saved:	Saved in instrument state.
Key Path:	**Input/Output**
Status Bits/OPC dependencies:	STATus:QUEStionable:FREQuency bit 2 set if unlocked.
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`[:SENSe]:ROSCillator:SOURce?`
Notes:	The query [SENSe]:ROSCillator:SOURce? returns the current switch setting. This means: 1. If it was set to SENSe but there is no external reference so the instrument is actually using the internal reference, then this query returns INTernal and not SENSe. 2. If it was set to SENSe and there is an external reference present, the query returns EXTernal and not SENSe. 3. If it was set to EXTernal, then the query returns "EXTernal" 4. If it was set to INTernal, then the query returns INTernal
Preset:	SENSe
Backwards Compatibility SCPI:	The query [:SENSe]:ROSCillator:SOURce? was a query-only command in ESA which always returned whichever reference the instrument was using. The instrument automatically switched to the ext ref if it was present. In PSA (which had no sensing) the command [:SENSe]:ROSCillator:SOURce set the reference (INT or EXT), so again its query returned the actual routing. Thus the query form of this command is 100% backwards compatible with both instruments.
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`[:SENSe]:ROSCillator:SOURce INTernal|EXTernal`

Notes:	([:SENSe]:ROSCillator:SOURce:TYPE INTernal|EXTernal and directly sets the routing to either internal or external.)
Initial S/W Revision:	Prior to A.02.00

Sense

The external reference is used if a valid signal is sensed at the Ext Ref input. Otherwise the internal reference is used.

Example:	:ROSC:SOUR:TYPE SENS
Key Path:	**Input/Output, Freq Ref In**
Readback:	Sense
Initial S/W Revision:	Prior to A.02.00

Internal

The internal reference is used.

Example:	:ROSC:SOUR:TYPE INT
Key Path:	**Input/Output, Freq Ref In**
Readback:	Internal
Initial S/W Revision:	Prior to A.02.00

External

The external reference is used.

Example:	:ROSC:SOUR:TYPE EXT
Key Path:	**Input/Output, Freq Ref In**
Readback:	External
Initial S/W Revision:	Prior to A.02.00

Ext Ref Freq

This key tells the analyzer the frequency of the external reference. When the external reference is in use (either because the reference has been switched to External or because the Reference has been switched to Sense and there is a valid external reference present) this information is used by the analyzer to determine the internal settings needed to lock to that particular external reference signal.

For the instrument to stay locked, the value entered must be within 5 ppm of the actual external reference frequency. So it is important to get it close, or you risk an unlock condition.

Note that this value only affects the instrument's ability to lock. It does not affect any calculations or measurement results. See "Freq Offset" in the Frequency section for information on how to offset frequency values.

Remote Command:	`[:SENSe]:ROSCillator:EXTernal:FREQuency <freq>` `[:SENSe]:ROSCillator:EXTernal:FREQuency?`
Example:	ROSC:EXT:FREQ 20 MHz !sets the external reference frequency to 20 MHz, but does not select the external reference. ROSC:SOUR:TYPE EXT !selects the external reference.
Notes:	Still available with Internal selected, to allow setup for when External is in use.
Preset:	This is unaffected by a Preset but is set to 10 MHz on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min:	CXA: 10 MHz EXA: 10 MHz MXA: 1 MHz PXA: 1 MHz
Max:	CXA: 10 MHz EXA: 10 MHz MXA: 50 MHz PXA: 50 MHz
Key Path:	**Input/Output, Freq Ref In**
Default Unit:	Hz
Initial S/W Revision:	Prior to A.02.00

External Reference Lock BW

This control lets you adjust the External Reference phase lock bandwidth. This control is available in some models of the X-Series.

The PXA variable reference loop bandwidth allows an external reference to be used and have the analyzer close-in phase noise improved to match that of the reference. This could result in an improvement of tens of decibels. The choice of “Wide” or “Narrow” affects the phase noise at low offset frequencies, especially 4 to 400 Hz offset. When using an external reference with superior phase noise, we recommend setting the external reference phase-locked-loop bandwidth to wide (60 Hz), to take advantage of that superior performance. When using an external reference with inferior phase noise performance, we recommend setting that bandwidth to narrow (15 Hz). In these relationships, inferior and superior phase noise are with respect to 134 dBc/Hz at 30 Hz offset from a 10 MHz reference. Because most reference sources have phase noise behavior that falls off at a rate of 30 dB/decade, this is usually equivalent to 120 dBc/Hz at 10 Hz offset.

Remote Command	`[:SENSe]:ROSCillator:BANDwidth WIDE|NARRow` `[:SENSe]:ROSCillator:BANDwidth?`

Example	ROSC:BAND WIDE
Initial S/W Revision	A.04.00
Key Path	**Input/Output, Freq Ref In**
Scope	Mode Global
Dependencies	This key only appears in analyzers equipped with the required hardware.
Preset	This is unaffected by a Preset but is set to Narrow on a "Restore Input/Output Defaults" or "Restore System Defaults -> All"
State Saved	Saved in Input/Output state.

External Ref Coupling

Only appears with option ERC installed and licensed.

This function lets you couple the sweep system of the analyzer to the state of the External Reference. If **Normal** is selected, data acquisition proceeds regardless of the state of the External Reference. When you select **Ext Ref Out Of Range Stops Acquisition**, the data acquisition (sweep or measurement) stops when either the "521, External ref out of range" or the "503, Frequency Reference unlocked" error is asserted. Note that this will only take place if the **Freq Ref In** selection is **External**.

With the acquisition stopped, the data display will stop updating (even if this occurs in the middle of a sweep or measurement) and no data will be returned to a READ? or MEASure? query; that is, these queries will not complete because the analyzer will not respond to them. Furthermore, no response will be generated to a *WAI? or *OPC? query.

Proper SCPI sequences are shown below, which will always fail to return if the acquisition stops during the requested sweep or measurement. Note that, for predictable operation of this function, it is best to operate the analyzer in single measurement mode (INIT:CONT OFF), because if operating in continuous mode, the analyzer may respond to the above queries even after the acquisition stops, with data left over from the previous acquisition.

:INIT:CONT OFF

:INIT:IMM;*OPC?

--

:INIT:CONT OFF

:INIT:IMM;*WAI?

--

:INIT:CONT OFF

:READ?

--

:INIT:CONT OFF

:MEASure?

When the acquisition ceases, in addition to the error condition(s) described above, an error message will be generated informing you that the acquisition has ceased due to an invalid external reference. This message will stay on the screen while the acquisition is suspended.

External reference problem.
Data acquisition suspended.
To resume data acquisition, fix the
problem and press the Restart key
OR
Press the following keys:
Input/Output, More 1 of 2, Freq Ref In,
External Ref Coupling, Normal
OR
Input/Output, More 1 of 2,
Freq Ref In, Internal

If you press the Restart key this message will be taken off the screen and a new acquisition will be attempted; if the External Reference problem persists the message will go right back up. You can also take the message down by changing back to the **Normal** setting of Sweep/Ext Ref Coupling, or by pressing **Freq Ref In, Internal**, or **Freq Ref In, Sense**, or **Restore Input/Output Defaults.**

The setting of **External Ref Coupling** is persistent across power-cycling and is not reset with a Preset. It is reset to the default state (**Normal**) when **Restore Input/Output Defaults** is invoked, which will also restart normal data acquisition.

The detection of invalid external reference is under interrupt processing. If the external reference becomes invalid then returns to valid in too short a time, no error condition will be detected or reported and therefore the acquisition will not be stopped.

Remote Command	`[:SENSe]:ROSCillator:COUPling NORMal|NACQuisition` `[:SENSe]:ROSCillator:COUPling?`
Initial S/W Revision	A.02.00
Key Path	**Input/Output, Freq Ref In**
Mode	All
Preset	This setting is persistent: it survives power-cycling or a Preset and is reset with Restore Input/Output defaults.
State Saved	Not saved in State
Readback	Normal|Stop Acq

Output Config

Accesses keys that configure various output settings, like the frequency reference output, trigger output and analog output.

Key Path	**Input/Output**

Initial S/W Revision	Prior to A.02.00

Trig Out (1 and 2)

Select the type of output signal that will be output from the rear panel Trig 1 Out or Trig 2 Out connectors.

Remote Command:	:TRIGger|TRIGger1|TRIGger2[:SEQuence]:OUTPut HSWP|MEASuring|MAIN|GATE|GTRigger|OEVen|SSWeep|SSETtled|S1Marker|S2Marker|S3Marker|S4Marker|OFF :TRIGger|TRIGger1|TRIGger2[:SEQuence]:OUTPut?
Example:	TRIG:OUTP HSWP TRIG2:OUTP GATE
Dependencies:	The second Trigger output (Trig 2 Out) does not appear in all models; in models that do not support it, the Trig 2 Out key is blanked, and sending the SCPI command for this output generates an error, “Hardware missing; Not available for this model number” In models that do not support the Trigger 2 output, this error is returned if trying to set Trig 2 Out and a query of Trig 2 Out returns OFF.
Preset:	Trigger 1: Sweeping (HSWP) Trigger 2: Gate This is unaffected by a Preset but is preset to the above values on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved:	Saved in instrument state
Key Path:	**Input/Output, Output Config**
Initial S/W Revision:	Prior to A.02.00

Polarity

Sets the output to the Trig 1 Out or Trig 2 Out connector to trigger on either the positive or negative polarity.

Remote Command:	:TRIGger|TRIGger1|TRIGger2[:SEQuence]:OUTPut:POLarity POSitive|NEGative :TRIGger|TRIGger1|TRIGger2[:SEQuence]:OUTPut:POLarity?
Example:	TRIG1:OUTP:POL POS
Preset:	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved:	Saved in instrument state
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Initial S/W Revision:	Prior to A.02.00

Sweeping (HSWP)

Selects the Sweeping Trigger signal to be output to the Trig 1 Out or Trig 2 Out connector when a measurement is made. This signal has historically been known as "HSWP" (High = Sweeping), and is 5 V TTL level with 50 ohm output impedance."

Example:	TRIG1:OUTP HSWP
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Readback:	Sweeping
Initial S/W Revision:	Prior to A.02.00

Measuring

Selects the Measuring trigger signal to be output to the Trig 1 Out or Trig 2 Out connector. This signal is true while the Measuring status bit is true.

Example:	TRIG1:OUTP MEAS
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Readback:	Measuring
Initial S/W Revision:	Prior to A.02.00

Main Trigger

Selects the current instrument trigger signal to be output to the Trig 1 Out or Trig 2 Out connector.

Example:	TRIG1:OUTP MAIN
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Readback:	Main Trigger
Initial S/W Revision:	Prior to A.02.00

Gate Trigger

Selects the gate trigger signal to be output to the Trig 1 Out or Trig 2 Out connector. This is the source of the gate timing, not the actual gate signal.

Example:	TRIG1:OUTP GTR
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Readback:	Gate Trigger
Initial S/W Revision:	Prior to A.02.00

Gate

Selects the gate signal to be output to the Trig 1 Out or Trig 2 Out connector. The gate signal has been delayed and its length determined by delay and length settings. When the polarity is positive, a high on the Trig 1 Out or Trig 2

Out represents the time the gate is configured to pass the signal.

Example:	TRIG1:OUTP GATE
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Readback:	Gate
Initial S/W Revision:	Prior to A.02.00

Odd/Even Trace Point

Selects either the odd or even trace points as the signal to be output to the Trig 1 Out or Trig 2 Out connector when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the analyzer is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative.

Example:	TRIG1:OUTP OEV
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Readback:	Odd/Even
Initial S/W Revision:	Prior to A.02.00

Off

Selects no signal to be output to the Trig 1 Out or Trig 2 Out connector.

Example:	TRIG1:OUTP OFF
Key Path:	**Input/Output, Output Config, Trig 1/2 Output**
Readback:	Off
Initial S/W Revision:	Prior to A.02.00

Analog Out

This menu lets you control which signal is fed to the “Analog Out” connector on the analyzer rear panel.

See also “More Information” on page 93.

Remote Command:	`:OUTPut:ANALog OFF|SVIDeo|LOGVideo|LINVideo|DAUDio` `:OUTPut:ANALog?`
Example:	OUTP:ANAL SVIDeo ! causes the analog output type to be Screen Video
Preset:	OFF
Preset:	This is unaffected by Preset but is set to DAUDio on a "Restore Input/Output Defaults" or "Restore System Defaults->All

Backwards Compatibility Notes:	Prior to A.04.00, OFF was the default functionality except when in the Analog Demod application or with Tune and Listen, in which case it was DAUDio, and there was no selection menu. So for backwards compatibility, Auto (:OUTP:ANAL:AUTO ON) will duplicate the prior behavior. The DNWB and SANalyzer parameters, which were legal in PSA but perform no function in the X-Series, are accepted without error.
State Saved:	Saved in Input/Output State
Key Path:	**Input/Output, Output Config**
Readback line:	1-of-N selection [variable]
Initial S/W Revision:	A.04.00

More Information

The table below gives the range for each output.

Analog Out	Nominal Range exc. (10% overrange)	Scale Factor	Notes
Off	0 V		
Screen Video	0 to 1 V open circuit	10%/division	8566 compatible
Log Video	0 to 1 V terminated	1/(192.66 dB/V)	dB referenced to mixer level, 1 V out for –10 dBm at the mixer.
Linear Video	0 to 1 V terminated	100%/V	Linear referenced to Ref Level, 1 V out for RF envelope at the Ref Level.
Demod Audio	(varies with analyzer setting)		

Auto

Selects the Auto state for the Analog Output menu. In this state, the Analog Output will automatically be set to the most sensible setting for the current mode or measurement.

If you make a selection manually from the Analog Out menu, this selection will remain in force until you change it (or re-select Auto), even if you go to a mode or measurement for which the selected output does not apply.

Remote Command:	`:OUTPut:ANALog:AUTO OFF|ON|0|1` `:OUTPut:ANALog:AUTO?`
Example:	OUTP:ANAL:AUTO ON
Preset:	ON

State Saved:	Saved in Input/Output State
Key Path:	**Input/Output, Output Config, Analog Out**
Initial S/W Revision:	A.04.00

Off

Turns off the analog output.

Example:	OUTP:ANAL OFF ! causes the analog output to be off
Key Path:	**Input/Output, Output Config, Analog Out**
Readback Text:	Off
Initial S/W Revision:	A.04.00

Screen Video

Selects the analog output to be the screen video signal. In this mode, the pre-detector data is output to the Analog Out connector. The output looks very much like the trace displayed on the analyzer's screen, and depends on the Log/Lin display Scale, Reference Level, and dB per division, but is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging).

Note that this mode is similar to the Analog Output of the HP 8566 family and the Video Out (opt 124) capability of the Agilent PSA analyzer (E444x), although there are differences in the behavior.

See "Backwards Compatibility:" on page 95.

Example:	OUTP:ANAL SVID
Dependencies:	Because the Screen Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Screen Video is activated. Screen Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Screen Video output. The output holds at its last value during an alignment and during a marker count and during retrace (after a sweep and before the next sweep starts). This function depends on optional capability; the key will be blanked and the command will generate an "Option not available" error unless you have Option YAV or YAS licensed in your instrument.
Couplings:	Screen Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Screen Video output will look different than it does in swept mode.
Key Path:	**Input/Output, Output Config, Analog Out**
Readback Text:	Screen Video
Initial S/W Revision:	A.04.00

Backwards Compatibility:

The Screen Video function is intended to be very similar to the 8566 Video Output and the PSA Option 124. However, unlike the PSA, it is not always on; it must be switched on by the Screen Video key. Also, unlike the PSA, there are certain dependencies (detailed above) – for example, the Quasi Peak Detector is unavailable when Screen Video is on.

Futhermore, the PSA Option 124 hardware was unipolar and its large range was padded to be exactly right for use as a Screen Video output. In the X-Series, the hardware is bipolar and has a wider range to accommodate the other output choices. Therefore, the outputs won’t match up exactly and users may have to modify their setup when applying the X-Series in a PSA application.

Log Video

Selects the analog output to be the log of the video signal. In this mode, the pre-detector data is output to the Analog Out connector with a Log scaling. The output does not depend on display settings like Reference Level or dB per division, and it is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging), but does change with input attenuation.

The output is designed so that full scale (1 V) corresponds to –10 dBm at the mixer.   The full range (0–1 V) covers 192.66 dB ; thus, 0 V corresponds to –202.66 dBm at the mixer.

Example:	OUTP:ANAL LOGV
Dependencies:	Because the Log Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated. Log Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Log Video output. The output holds at its last value during an alignment, during a marker count, and during retrace (after a sweep and before the next sweep starts). This function depends on optional capability. The key will be blanked and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.
Couplings:	Log Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Log Video output will look different than it does in swept mode.
Key Path:	**Input/Output, Output Config, Analog Out**
Readback Text:	Log Video
Initial S/W Revision:	A.04.00

Linear Video

Selects the analog output to be the envelope signal on a linear (voltage) scale. In this mode, the pre-detector data is output to the Analog Out connector with a Linear scaling. The output is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging).

The scaling is set so that 1 V output occurs with an instantaneous video level equal to the reference level, and 0 V occurs at the bottom of the graticule. This scaling gives you the ability to control the gain without having another setup control for the key. But it requires you to control the look of the display (the reference level) in order to control the analog output.

This mode is ideal for looking at Amplitude Modulated signals, as the linear envelope effectively demodulates the signal.

Example:	OUTP:ANAL LINV
Dependencies:	Because the Linear Video output uses one of the two IF processing channels, only one detector is available while Linear Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated. Linear Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Linear Video output. The output holds at its last value during an alignment and during a marker count and during retrace (after a sweep and before the next sweep starts). This function depends on optional capability; the key will be blanked and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.
Couplings:	Linear Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Linear Video output will look different than it does in swept mode.
Key Path:	**Input/Output, Output Config, Analog Out**
Readback Text:	Linear Video
Initial S/W Revision:	A.04.00

Demod Audio

Selects the analog output to be the demodulation of the video signal.

When Demod Audio is selected, the demodulated audio signal appears at this output whenever the Analog Demod application is demodulating a signal or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement.

When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement.

If any other Analog Output is manually selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement, a warning message appears in the status message bar.

Example:	OUTP:ANAL DAUD

Dependencies:	This key only appears if the Analog Demod application (N9063A) or Option EMC is installed and licensed, otherwise the key will be blanked and the command will generate an "Option not available" error. The output holds at its last value during an alignment and during a marker count. It is not held between sweeps, in order for Tune and Listen to work properly. When Demod Audio is the selected Analog Output: • all active traces are forced to use the same detector. • CISPR detectors (QPD, EMI Avg, RMS Avg) are unavailable
Key Path:	**Input/Output, Output Config, Analog Out**
Readback Text:	Demod Audio
Initial S/W Revision:	Prior to A.02.00 (this was the default functionality, and there was no selection)
Modified at S/W Revision:	A.04.00

I/Q Cal Out

The Baseband I/Q "Cal Out" port can be turned on with either a 1 kHz or a 250 kHz square wave. This can be turned on independent of the input selection. A Preset will reset this to Off.

Remote Command	`:OUTPut:IQ:OUTPut IQ1|IQ250|OFF` `:OUTPut:IQ:OUTPut?`
Example	OUTP:IQ:OUTP IQ1
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, Output Config**
Couplings	An I/Q Cable Calibration or an I/Q Probe Calibration will change the state of the Cal Out port as needed by the calibration routine. When the calibration is finished the I/Q Cal Out is restored to the pre-calibration state.
Preset	Off
State Saved	Saved in instrument state.
Range	1 kHz Square Wave|250 kHz Square Wave|Off
Readback Text	1 kHz|250 kHz|Off

1 kHz Square Wave

Turns on the 1 kHz square wave signal at the Cal Out port. This choice is only available with option BBA.

Key Path	**Input/Output, Output Config, I/Q Cal Out**
Readback	I/Q 1kHz
Initial S/W Revision	Prior to A.02.00

250 kHz Square Wave

Turns on the 250 kHz square wave signal at the Cal Out port. This choice is only available with option BBA.

Key Path	**Input/Output, Output Config, I/Q Cal Out**
Readback	I/Q 250kHz
Initial S/W Revision	Prior to A.02.00

Off

Turns off the signal at the Cal Out port. This choice is only available with option BBA.

Key Path	**Input/Output, Output Config, I/Q Cal Out**
Readback	Off
Initial S/W Revision	Prior to A.02.00

Digital Out

Opens a menu that allows you to select options for configuring the digital output(s) of the analyzer.

Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, Output Config**
Modified at S/W Revision	A.04.00

Digital Bus (Narrowband)

This menu allows you to configure the LVDS connector located on the rear panel of the instrument. It is a unidirectional link of real time data at a 90 MSa/s rate. The ADC is sampling a 22.5 MHz IF.

The data that appears on this port is raw, uncorrected ADC samples, unless you have option RTL. With option RTL, you get fully corrected I/Q data.

This connector will only be active when the Narrowband IF Path is currently in use.

Key Path	**Input/Output, Output Config, Digital Out**
Initial S/W Revision	A.04.00

Bus Out On/Off

When Bus Out is on, all acquisitions are streamed to the output port including acquisitions for internal purposes such as Alignment; internal processing and routing of acquisitions continues as usual and is unaffected by the state of Bus Out.

When Bus Out is off, no signal appears on the LVDS port.

Remote Command	`:OUTPut:DBUS[1][:STATe] ON|OFF|1|0` `:OUTPut:DBUS[1][:STATe]?`

Example	OUTP:DBUS ON
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, Output Config, Digital Out, Digital Bus**
Scope	Mode Global
Preset	This is unaffected by a Preset but is set to Off on a "Restore Input/Output Defaults" or "Restore System Defaults -> All"
State Saved	Saved in Input/Output State
Modified at S/W Revision	A.04.00

Aux IF Out

This menu controls the signals that appear on the SMA output on the rear panel labeled “AUX IF OUT”:

Remote Command:	`:OUTPut:AUX SIF|AIF|LOGVideo|OFF` `:OUTPut:AUX?`
Preset:	This is unaffected by a Preset but is set to OFF on a "Restore Input/Output Defaults" or "Restore System Defaults->All”
State Saved:	Saved in Input/Output state
Key Path:	**Input/Output, Output Config**
Readback line:	1-of-N selection [variable]
Backwards Compatibility Notes:	In the PSA, the IF output has functionality equivalent to the "Second IF" function in the X-Series’ Aux IF Out menu. In the X-Series, it is necessary to switch the Aux IF Out to “Second IF” to get this functionaluity, whereas in PSA it is always on, since there are no other choices. Hence a command to switch this function to “Second IF” will have to be added by customers migrating from PSA who use the IF Outputin PSA.
Initial S/W Revision:	A.04.00

Second IF

In this mode the 2nd IF output is routed to the rear panel connector. The annotation on the key shows the current 2nd IF frequency in use in the analyzer.

The frequency of the 2nd IF depends on the current IF signal path as shown in the table below:

IF Path Selected	Frequency of “Second IF” Output
10 MHz	322.5 MHz
25 MHz	322.5 MHz
40 MHz	250 MHz
140 MHz	300 MHz

The signal quality, such as signal to noise ratio and phase noise, are excellent in this mode.

Example:	OUTP:AUX SIF causes the aux output type to be Second IF
Key Path:	**Input/Output, Output Config, Aux IF Out**
Readback Text:	Second IF
Initial S/W Revision:	A.04.00

Arbitrary IF

In this mode the 2nd IF output is mixed with a local oscillator and mixer to produce an arbitrary IF output between 10 MHz and 75 MHz with 500 kHz resolution. The phase noise in this mode will not be as good as in **Second IF** mode.

The IF output frequency is adjustable, through an active function which appears on the Arbitrary IF selection key, from 10 MHz to 75 MHz with 500 kHz resolution.

The bandwidth of this IF output varies with band and center frequency, but is about 40 MHz at the –3 dB width. When the output is centered at lower freqeuncies in its range, signal frequencies at the bottom of the bandwidth will “fold”. For example, with a 40 MHz bandwidth (20 MHz half-bandwidth), and a 15 MHz IF center, a signal –20 MHz relative to the spectrum analyzer center frequency will have a relative response of about –3 dB with a frequency 20 MHz below the 15 MHz IF center. This –5 MHz frequency will fold to become a +5 MHz signal at the IF output. Therefore, lower IF output frequencies are only useful with known band-limited signals.

Example:	OUTP:AUX AIF causes the aux output type to be the Arbitrary IF
Key Path:	**Input/Output, Output Config, Aux IF Out**
Readback Text:	Arbitrary IF
Initial S/W Revision:	A.04.00

Key Path	**Input/Output, Output Config, Aux IF Out**
Scope	Mode Global
Remote Command	`:OUTPut:AUX:AIF <value>` `:OUTPut:AUX:AIF?`
Example	:OUTP:AUX:AIF 50 MHZ
Preset	This is unaffected by a Preset but is set to 70 MHz on a "Restore Input/Output Defaults" or "Restore System Defaults->All”
State Saved	Saved in Input/Output State
Min	10 MHz
Max	75 MHz
Default Unit	Hz

Initial S/W Revision	A.04.00

Fast Log Video

In this mode the 2nd IF output is passed through a log amp and the log envelope of the IF signal is sent to the rear panel. The open circuit output level varies by about 25 mV per dB, with a top-of-screen signal producing about 1.6 Volts. The output impedance is nominally 50 ohms.

This mode is intended to meet the same needs as Option E4440A-H7L Fast Rise Time Video Output on the Agilent E4440A PSA Series, allowing you to characterize pulses with fast rise times using standard measurement suites on modern digital scopes.

Example:	OUTP:AUX LOGVideo causes the aux output type to be Fast Log Video
Dependencies:	The output is off during an alignment but not during a marker count, and is not blanked during retrace (after a sweep and before the next sweep starts).
Key Path:	**Input/Output, Output Config, Aux IF Out**
Readback Text:	Fast Log Video
Initial S/W Revision:	A.04.00

Off

In this mode nothing comes out of the “AUX IF OUT” connector on the rear panel. The connector appears as an open-circuit (that is, it is not terminated in any way).

Example:	OUTP:AUX OFF causes the aux output type to be off
Key Path:	**Input/Output, Output Config, Aux IF Out**
Readback Text:	Off
Initial S/W Revision:	A.04.00

I/Q Guided Calibration

Calibrating the Baseband I/Q ports requires several steps and manual connections. The Guided Calibration will interactively step a user through the required steps, displaying diagrams to help with the connections. The steps will vary depending on the setup.

In the Guided Calibration windows, the date and time of the last calibration are displayed. If any of the items listed are displayed in yellow, this indicates that the calibration for that item is inconsistent with the latest calibration, and you should complete the entire calibration process before you exit the calibration.

I/Q Isolation Calibration

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. This calibration is performed with nothing connected to any of the front panel I/Q ports. This is the first step in both the I/Q Cable Calibration and the I/Q Probe

Calibration.

Next

Perform the I/Q Isolation calibration.

Remote Command	`:CALibration:IQ:ISOLation`
Example	CAL:IQ:ISOL
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I/Q Cable Calibration**
Notes	All front panel I/Q ports must not be connected to anything.
Notes	All cables and probes should be disconnected from the I/Q ports before issuing the SCPI command.
State Saved	No.

Exit

Exits the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, I/Q Cable Calibration**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

I/Q Isolation Calibration Time (Remote Command Only)

Returns the last date and time that the I/Q Isolation Calibration was performed. This is a remote query command only.

Remote Command:	`:CALibration:IQ:ISOLation:TIME?`
Example:	:CAL:IQ:ISOL:TIME?
Notes:	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0.
Initial S/W Revision:	A.02.00

I/Q Cable Calibrate…

The I/Q cable calibration creates correction data for each of the front panel I/Q ports. This calibration data is used whenever no probe specific calibration data is available. It is important that all ports are calibrated using the same short BNC cable so that the data is comparable from port to port.

The guided calibration (front panel only) will show connection diagrams and guide the user through the isolation calibration and calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If a user presses "Exit" to exit the calibration process, the data for the ports already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the I/Q ports. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both softkeys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. The user will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:FLAT:I|IB|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each port will be displayed. Any calibrations that are more than a day older than the most recent calibration will be displayed with the color amber.

Key Path	**Input/Output, I/Q**
Initial S/W Revision	Prior to A.02.00

I Port

The I port calibration is performed with the front panel's I port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Initial S/W Revision	Prior to A.02.00

Next

Perform the I port calibration.

Remote Command	`:CALibration:IQ:FLATness:I`

Example	CAL:IQ:FLAT:I
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The I port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No.

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

I-bar Port

The I-bar port calibration is performed with the front panel's I-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, I/Q Cable Calibration**
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

Next

Perform the I-bar port calibration.

Remote Command	`:CALibration:IQ:FLATness:IBAR`

Example	CAL:IQ:FLAT:IBAR
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The I-bar port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

Q Port

The Q port calibration is performed with the front panel's Q port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

Next

Perform the Q port calibration.

Remote Command	`:CALibration:IQ:FLATness:Q`

Example	CAL:IQ:FLAT:Q
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The Q port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

Q-bar Port

The Q-bar port calibration is performed with the front panel's Q-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

Next

Perform the Q-bar port calibration.

Remote Command	`:CALibration:IQ:FLATness:QBAR`

Example	CAL:IQ:FLAT:QBAR
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The Q-bar port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, I/Q Cable Calibrate…**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

I/Q Cable Calibration Time (Remote Command Only)

Returns the last date and time that the I/Q Cable Calibration was performed for a specific port. This is a remote query command only.

Remote Command:	`:CALibration:IQ:FLATness:I|IBAR|Q|QBAR:TIME?`
Example:	:CAL:IQ:FLAT:I:TIME?
Notes:	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0.
Initial S/W Revision:	A.02.00

I/Q Probe Calibration

The I/Q probe calibration creates correction data for one of the front panel I/Q channels. When the probe has EEPROM identification, the data is unique to that specific probe. When the probe does not have EEPROM identification, the data will be used for all probes of the same type. The data is also unique to the channel, so calibration data for the I channel will not be used for the Q channel and vice versa.

The guided calibration (front panel only) will show connection diagrams and guide the user through the I/Q Isolation Calibration and through calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If a user presses "Exit" to exit the calibration process, the data for the port already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the probe. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both softkeys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. The user will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

For Active probes or when Differential is Off, only the main port is calibrated, otherwise both the main and complementary ports are calibrated.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:PROB:I|IB|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each relevant port will be displayed. For passive probes with Differential On, any calibration that is more than a day older than the most recent calibration will be displayed with the color amber.

I Port

The I port calibration is performed with the probe body attached to the front panel's I port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

Show Adapter

Show a connection diagram and instructions for the probe and adapter. See "Show Adapter Screen" on page 113.

Key Path	**Input/Output, I/Q, I Setup, I Probe, Calibrate**
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**

Initial S/W Revision	Prior to A.02.00

Next

Perform the I port calibration.

Remote Command	`:CALibration:IQ:PROBe:I`
Example	CAL:IQ:PROB:I
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I Setup, I Probe, Calibrate**
Notes	The I port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, I Setup, I Probe, Calibrate**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

I-bar Port

The I-bar port calibration is performed with the probe body attached to the front panel's I-bar port and the probe tip connected via an adapter to the Cal Out port. The I-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

Show Adapter

Show a connection diagram and instructions for the probe and adapter. See “Show Adapter Screen” on page 113.

Key Path	**Input/Output, I/Q, I Setup, I Probe, Calibrate**
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, I Setup, I Probe, Calibrate**
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

Next

Perform the I-bar port calibration.

Remote Command	`:CALibration:IQ:PROBe:IBar`
Example	CAL:IQ:PROB:IB
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, I Setup, I Probe, Calibrate**
Notes	The I-bar port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, I Setup, I Probe, Calibrate**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

Q Port

The Q port calibration is performed with the probe body attached to the front panel's Q port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

Show Adapter

Show a connection diagram and instructions for the probe and adapter. See "Show Adapter Screen" on page 113.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Initial S/W Revision	Prior to A.02.00

Next

Perform the Q port calibration.

Remote Command	`:CALibration:IQ:PROBe:Q`
Example	CAL:IQ:PROB:Q
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Notes	The Q port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see "Exit Confirmation" on page 113).
Initial S/W Revision	Prior to A.02.00

Q-bar Port

The Q-bar port calibration is performed with the probe body attached to the front panel's Q-bar port and the probe tip connected via an adapter to the Cal Out port. The Q-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

Show Adapter

Show a connection diagram and instructions for the probe and adapter. See “Show Adapter Screen” on page 113.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

Back

Return to the prior step in the calibration procedure.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

Next

Perform the Q-bar port calibration.

Remote Command	`:CALibration:IQ:PROBe:QBar`
Example	CAL:IQ:PROB:QB
Initial S/W Revision	Prior to A.02.00
Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**
Notes	The Q-bar port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No

Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	**Input/Output, I/Q, Q Setup, Q Probe, Calibrate**

Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see “Exit Confirmation” on page 113).
Initial S/W Revision	Prior to A.02.00

Show Adapter Screen

When one of the Probe Calibration Show Adapter buttons is pressed, a diagram of the probe with its adapter will be shown. Depending on the type of probe attached, either the Passive Probe Adapter or the Active Probe Adapter diagram will be shown.

I/Q Probe Calibration Time (Remote Command Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port. This is a remote query command only.

Remote Command:	`:CALibration:IQ:PROBe:I|IBAR|Q|QBAR:TIME?`
Example:	:CAL:IQ:PROB:I:TIME?
Notes:	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected.
Initial S/W Revision:	A.02.00

Exit Confirmation

When Exit is pressed during one of the calibration routines, the calibration may be in an inconsistent state with some of the ports having newly measured calibration data and others with old data. If this is the case, a dialog box will appear to confirm that the user really wants to exit. A "Yes" answer will exit the calibration procedure, leaving potentially inconsistent calibration data in place. A "No" answer will return to the calibration procedure.

Marker

See “Marker Control Mode” on page 114.

See “Setting the Marker X Axis Value” on page 114.

See “Setting the Marker X Position in Trace Points” on page 115.

See “Setting the Marker Y Axis Value” on page 116.

The Marker key accesses the Marker menu. A marker can be placed on a trace to allow the value of the trace at the marker point to be determined precisely. The functions in this menu include a 1-of-N selection of the control mode Normal, Delta, Fixed, or Off for the selected marker. If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the Marker Trace rules.

Markers may also be used in pairs to read the difference (or delta) between two data points. They can be used in Marker Functions to do advanced data processing, or to specify operating points in functions like Signal Track and N dB Points.

The SCPI command in the table below selects the marker and sets the marker control mode as described under **Normal**, **Delta**, **Fixed** and **Off**, below. All interactions and dependencies detailed under the key description are enforced when the remote command is sent.

Remote Command:	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MODE POSition|DELTa|FIXed|OFF` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MODE?`
Preset:	OFF (all markers)
State Saved:	The marker control mode is saved in instrument state
Backwards Compatibility SCPI:	:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MODE SPAN|BAND These parameters are aliased to POSition if sent. A query does not reflect them.
Initial S/W Revision:	Prior to A.02.00

Marker Control Mode

There are four control modes for markers:

Normal (POSition) - A marker that can be moved to any point on the X Axis by specifying its X Axis value, and who's absolute Y Axis value (see section 8.1.4.7) is then the value of the trace point at that X Axis value.

Delta (DELTa) - A marker that can be moved to any point on the X Axis by specifying its X Axis offset from a reference marker, and whose absolute Y Axis value (see section 8.1.4.7) is then the value of the trace point at that X Axis value.

Fixed (FIXed) - A marker whose X Axis and Y Axis values may be directly or indirectly specified by you, but whose Y Axis value remains fixed, once specified, and does not follow the trace. Fixed markers are useful as reference markers for Delta markers, as operands in a Peak Search operation, and as arbitrary reference points settable by you. These markers are represented on the display by an "X" rather then a diamond.

Off (OFF) - A marker which is not in use.

In the Swept SA measurement, the Preset control mode is Off for all markers.

Setting the Marker X Axis Value

The command below sets the marker X Axis value in the current marker X Axis Scale unit. In each case the marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is **Off, but** it is the SCPI equivalent of entering an X value if the control mode is **Normal, Delta,** or **Fixed**.

Remote Command:	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X <freq>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X?`

Notes:	If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix error will be generated. If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "–221, Settings conflict" warning. The query returns the marker's absolute X Axis value if the control mode is **Normal** or **Fixed**. It returns the offset from the marker's reference marker if the control mode is **Delta**. The query is returned in the fundamental units for the current marker X Axis scale: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **Time**. If the marker is **Off** the response is not a number.
Preset:	After a preset, if X is queried with no value sent first, the center of screen value will be returned. This will depend on the frequency range of the instrument. 13.255 GHz is correct for the 26 GHz instruments only (Option 526).
Min:	– ∞ (minus infinity)
Max:	+ ∞ (plus infinity). Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
Default Unit:	determined by X Axis Scale
Backwards Compatibility SCPI:	:CALCulate:MARKer[1]|2|3|4:X:CENTer
Initial S/W Revision:	Prior to A.02.00

Setting the Marker X Position in Trace Points

The command below sets the marker X position in trace points. It has no effect if the marker control mode is **Off. B**ut it is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** or **Fixed** – except the setting is in trace points rather than X Axis Scale units.

NOTE The entered value in Trace Points is immediately translated into the current X Axis Scale units for setting the value of the marker. The marker's value in X Axis Scale Units, NOT trace points, will be preserved if a change is made to the X Axis scale settings. Thus, if you use this command to place a marker on bucket 500, which happens at that time to correspond to 13 GHz, and then you change the Start Frequency so that bucket 500 is no longer 13 GHz, the marker will stay at 13 GHz, NOT at bucket 500! This is important to realize as it differs from the behavior of past Agilent analyzers.

Remote Command:	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X:POSition <real>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X:POSition?`
Notes:	If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "–221, Settings conflict" warning. The query returns the marker's absolute X Axis value in trace points if the control mode is **Normal** or **Fixed**. It returns the offset from the marker's reference marker in trace points if the control mode is **Delta**. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points
Preset:	After a preset, if X is queried with no value sent first, the center of screen value will be returned. So if per default, the number of Trace points is 1001, the center value will be 500.
Min:	0
Max:	Number of trace points – 1
Default Unit:	unitless
Backwards Compatibility SCPI:	:CALCulate:MARKer[1]|2|3|4:X:POSition:CENTer
Backwards Compatibility SCPI:	The legacy command, :CALCulate:MARKer[n]:X:POSition:CENTer <param> was used to control the centerpoint between the Delta and Reference marker in trace points (buckets) in Span Pair mode. In the new system, this is equivalent to simply setting the marker position in trace points. So this command is aliased to the command :CALCulate:MARKer[n]:X:POSition <param> **NOTE** The UP/DOWN parameters will increment/decrement by one bucket. This will require a conversion to buckets and back.
Initial S/W Revision:	Prior to A.02.00

Setting the Marker Y Axis Value

The command below selects the marker and sets the marker Y Axis value; the default unit is the current Y Axis unit. It has no effect (other than selecting the marker) unless the marker control mode is **Fixed.**

Remote Command:	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Y <real>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Y?`

Example:	CALC:MARK2:MODE POS turns on marker 2 as a normal marker. CALC:MARK2:X 20 GHZ moves marker 2 to 20 GHz if X Axis Scale is Frequency. If X Axis Scale is Time, the –131 invalid suffix error is generated.
Preset:	Trace value at center of screen. There is no way to predict what this will be after a preset.
Min:	– ∞ (minus infinity)
Max:	+ ∞ (plus infinity)
Initial S/W Revision:	Prior to A.02.00

Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected by the functions.

Key Path	**Marker**
Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak.
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Normal

Sets the control mode for the selected marker to **Normal** and turns on the active function for setting its value. If the selected marker was **Off**, it is placed at the center of the screen on the trace specified by the marker’s Trace attribute.

A Normal mode (POSition type) marker can be moved to any point on the X Axis by specifying its X Axis value. Its absolute Y Axis value is then the value of the trace point at that X Axis value.

Key Path	**Marker**
Example	:CALC:MARK:MODE POS sets Marker 1 to Normal.
Notes	See the description under the “ Marker” key, above.
Couplings	• The marker addressed by this command becomes the selected marker on the front panel.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Delta

Sets the control mode for the selected marker to Delta and turns on the active function for setting its delta value. If the selected marker was **Off**, it is placed at the center of the screen on the trace specified by the marker's Trace attribute.

In Delta mode the marker result shows the relative result between the selected (Delta) marker and its reference marker. A delta marker can be moved to any point on the X Axis by specifying its X Axis offset from a reference marker. Its absolute Y Axis value is then the value of the trace point at that X Axis value.

Key Path	**Marker**
Example	:CALC:MARK:MODE DELT sets marker 1 to Delta.
Notes	See the description under the “ Marker” key, above.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state
Initial S/W Revision	Prior to A.02.00

Fixed

See “Fixed Marker X Axis Value” on page 119.

See “Fixed Marker Y Axis Value” on page 119.

Sets the control mode for the selected marker to Fixed. A fixed marker is fixed in the sense that it stays where you place it. It can be directly moved in both X and Y. It can be moved with a Peak Search. It can also be indirectly moved by re-zeroing the delta if it is a relative marker. If it is moved, it again becomes fixed at the X Axis point it moved to and it has a Y-axis result that it took on when it moved there. If a Normal or Delta marker is changed to Fixed it becomes fixed at the X Axis point it was at, and with the Y-axis result it had when it was set to Fixed.

In Fixed mode the marker result shows:

- If no Marker Function is on, the absolute X Axis and Y axis value of the marker
- If a Marker Function is on, the X Axis value and the Y-axis function result the marker had when it became fixed.

Fixed Marker X Axis Value

Key Path	**Marker, Fixed**
Example	:CALC:MARK:MODE FIX sets Marker 1 to Fixed.
Notes	See the description under the “ Marker” key, above.
Dependencies	You cannot directly set the X or Y value of a Fixed marker which has a marker function turned on. If an attempt is made to actually adjust it while a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning. you cannot directly set the Y value of a Fixed marker while Normalize is turned on. If an attempt is made to do so while Normalize is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X and Y Axis values are saved in instrument state
Initial S/W Revision	Prior to A.02.00

Fixed Marker Y Axis Value

Key Path	**Marker, Fixed**
Example	:CALC:MARK:MODE FIX sets Marker 1 to Fixed.
Notes	See the description under the **Marker** key, above.
Dependencies	you cannot directly set the X or Y value of a Fixed marker which has a marker function turned on. If an attempt is made to actually adjust it while a Marker Function is on, , a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X and Y Axis values are saved in instrument state
Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

Off

Turns off the selected marker and its marker function setting, if any. However, Off does not affect which marker is selected.

Key Path	**Marker**
Example	:CALC:MARK:MODE OFF sets Marker 1 to Off.
Notes	See the description under the “ Marker” key, above.

State Saved	The marker control mode (Normal, Delta, Fixed, Off) is saved in instrument state
Initial S/W Revision	Prior to A.02.00

Properties

Opens a menu used to set certain properties of the selected marker.

Key Path	**Marker**
Initial S/W Revision	Prior to A.02.00

Select Marker

Duplicate of the **Select Marker** key under **Marker**. Selecting a marker here causes the same marker to be selected under **Marker.** (That is, there is only one "selected marker".)

Relative To

Selects the marker that the selected marker will be relative to (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "reference marker" for that marker. This attribute is set by the **Marker, Properties, Relative To** key. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Key Path	**Marker, Properties**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:REFerence <integer>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:REFerence ?`
Example	CALC:MARK1:REF 2 sets the marker 1 reference marker to 2 and turns marker 1 on as a delta marker.
Notes	A marker cannot be relative to itself so that choice is grayed out. If the grayed out key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "–221, Settings conflict" warning. See error –221.2200 in Master Error Messages: X-Series document for exact error text.
Notes	This command causes the marker specified with the subopcode to become selected. Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped.
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker. If the reference marker is off it is turned on in **Fixed** mode at the delta marker location.

Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it's default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1. Set to the defaults by using **Restore Mode Defaults**. This is not reset by **Marker Off**, **All Markers Off**, or **Preset**.
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle.
Min	1
Max	12
Status Bits/OPC dependencies	none Default (selected when **Restore Mode Defaults** is pressed): next higher numbered marker or 1 if marker 12.
Initial S/W Revision	Prior to A.02.00

X Axis Scale (formerly Readout)

Accesses a menu that enables you to affect how the X Axis information for the selected marker is displayed in the marker area (top-right of display) and the active function area of the display, and how the marker is controlled. The available settings for the X Axis Scale are Frequency, Period, Time, and Inverse Time.

See "More Information" on page 122.

Key Path	**Marker, Properties**

Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X:READout FREQuency|TIME|ITIMe|PERiod`
	
	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X:READout?`
	
	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X:READout:AUTO ON|OFF|1|0`
	
	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X:READout:AUTO?`

Example	CALC:MARK3:X:READ TIME sets the marker 3 X Axis Scale to Time.
Notes	This command causes the specified marker to become selected.
Notes	This command causes the specified marker to become selected.
Preset	AUTO Marker Preset (selected when a marker is turned **Off**): **Auto** (see below). In most measurements the Auto settings results in Frequency being the preset readout.
State Saved	Saved in instrument state

Initial S/W Revision	Prior to A.02.00

More Information

The **X Axis Scale** of a marker is the scale of its X Axis value. This affects the units displayed in the Marker Result block and used to specify the marker's X Axis location. The X Axis Scale is specified using the **Marker, Properties, X Axis Scale** key.

All markers in swept spans have both a time and frequency value. Which of these is used for the result display, and for positioning the marker, depends on the **X Axis Scale** setting. The **X Axis Scale** setting can be **Frequency** or **Time**, as well as the reciprocal of either (**Period** or **Inverse Time**). There is also an **Auto** setting - when in **Auto**, a marker's **X Axis Scale** changes whenever the domain of the trace, upon which it set, changes. All choices for **X Axis Scale** are allowed. Note that this behavior differs from the behavior in previous instruments: previously the instrument remembered a different **X Axis Scale** (formerly called **Readout**) for each domain, and the choices of **X Axis Scale** were restricted. These restrictions were based on the current domain of the instrument.

Auto

When in Auto, the X-Axis Scale is **Frequency** if the Marker Trace is a frequency domain trace, **Time** if the Marker Trace is a time domain trace. When in Auto, if the marker changes traces, or the domain of the trace the marker is on changes, the auto result is re-evaluated. If the X Axis Scale is chosen manually, that Scale is used regardless of the domain of the trace.

Key Path	**Marker, Properties, X Axis Scale**
Example	CALC:MARK2:X:READ:AUTO ON sets the marker 2 X-axis scaling to automatically select the most appropriate units.
Initial S/W Revision	Prior to A.02.00

Frequency

Sets the marker X Axis scale to Frequency, displaying the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker. Frequency is the auto setting for frequency domain traces.

If Frequency is selected for a time domain trace, all of the points in the trace will show the same value. Attempting to use the knob or step keys to adjust the X Axis value of the marker or entering an X Axis value from the numeric keypad or remotely will have no effect but will generate no error.

Key Path	**Marker, Properties, X Axis Scale**
Example	CALC:MARK2:X:READ FREQ !sets the marker 2 X Axis scale to Frequency.
Notes	1-of-N readback is **Frequency**
State Saved	The X Axis Scale setting is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Period

Sets the marker X Axis scale to Period, displaying the reciprocal of the frequency of the marker, or the reciprocal of the frequency separation of the two markers in a delta-marker mode. The units are those of time (sec, msec, etc). If the markers are at the same frequency in a delta marker mode, the result will be the reciprocal of 0, which is infinitely large. The display will show “---” and a SCPI query will return infinity.

If Period is selected for a time domain trace, all of the points in the trace will show the same value. Attempting to use the knob or step keys to adjust the X Axis value of the marker or entering an X Axis value from the numeric keypad or remotely will have no effect but will generate no error.

Key Path	**Marker, Properties, X Axis Scale**
Example	CALC:MARK2:X:READ PER sets the marker 2 X Axis scale to Period.
Notes	1-of-N readback is **Period**
State Saved	The X Axis Scale setting is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Time

Sets the marker X Axis scale to Time, displaying the time interval between a normal marker and the start of a sweep or the time of the delta marker relative to the reference marker. Time is the auto setting for time domain traces. In a delta-marker mode it is the (sweep) time interval between the two markers.

Key Path	**Marker, Properties, X Axis Scale**
Example	CALC:MARK2:X:READ TIME sets the marker 2 X Axis Scale to Time..
Notes	1-of-N readback is **Time**
Couplings	Frequency domain traces taken in FFT mode have no valid time data. Therefore when Time is selected for markers on such traces, the X Axis value is taken as the appropriate percentage of the displayed sweep time, which is a calculated estimate.
State Saved	The X Axis Scale setting is saved in instrument state
Initial S/W Revision	Prior to A.02.00

Inverse Time

Sets the marker X Axis scale to Inverse Time, displaying the reciprocal time. It is useful in a delta mode to show the reciprocal of (sweep) time between two markers. This function is only meaningful when on a time domain trace and in the **Delta** control mode. If the markers are at the same X Axis value, the time between them is 0, so the reciprocal of sweep time is infinitely large. The display will show “---” and a SCPI query will return infinity.

Key Path	**Marker, Properties, X Axis Scale**
Example	:CALC:MARK2:X:READ ITIM sets the marker 2 X Axis scale to Inverse Time.
Notes	1-of-N readback is **Inverse Time**
Couplings	Frequency domain traces taken in FFT mode have no valid time data. Therefore when Inverse Time is selected for markers on such traces, the X Axis value is undefined, shows as “---” and returns not a number to a query.
State Saved	The X Axis Scale setting is saved in instrument state

Initial S/W Revision	Prior to A.02.00

Marker Trace

Selects the trace that you want your marker to be placed on. A marker is associated with one and only one trace. This trace is used to determine the placement, result, and X Axis Scale of the marker. All markers have an associated trace, even **Fixed** markers; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal or Delta markers.

See "Auto Init On" on page 124.

See "Auto Init Rules Flowchart" on page 125.

See "Auto Init OFF" on page 125.

Key Path	**Marker, Properties**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe 1|2|3|4|5|6` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?`
Example	CALC:MARK1:TRAC 2 places marker 1 on trace 2.
Notes	A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating. An application may register a trace name to be displayed on the key instead of a trace number.
Couplings	The state of Marker Trace is not affected by the Auto Couple key. If a Marker Trace is chosen manually, Auto Init goes to Off for that marker. Sending the remote command causes the addressed marker to become selected.
Preset	Presets on Preset or All Markers Off
State Saved	The Marker Trace and state of **Auto Init** for each marker is saved in instrument state.
Min	1
Max	6
Readback line	[TraceN, Auto Init] or [TraceN, Manual] where N is the trace number to which the marker is currently assigned.
Initial S/W Revision	Prior to A.02.00

Auto Init On

When **Auto Init** is true, the marker's trace attribute is re-determined automatically by the analyzer whenever the marker turns on (Normal, Delta or Fixed) from an Off state. (The trace attribute is also determined for all markers that are on, whenever **Auto Init** is turned on).

When the marker moves between traces the marker's X position in trace points is retained as it moves.

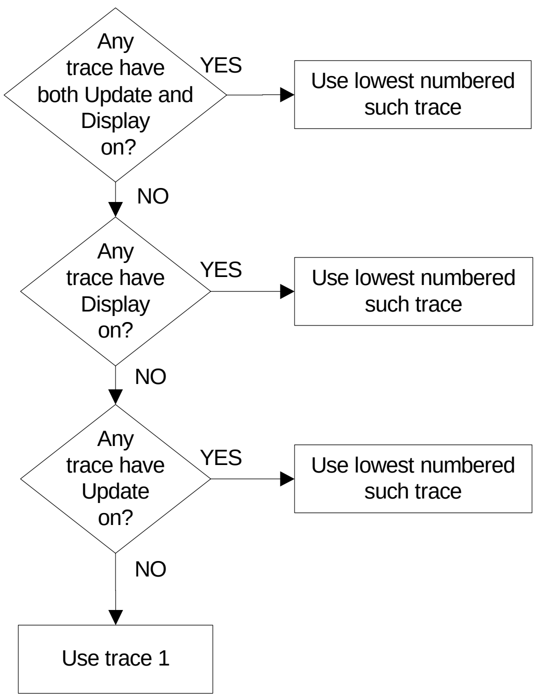
For moving between active traces this generally means the x-axis value of the marker will not change. But for moving to or from an inactive trace, the x-axis value will take on that of the new trace at the bucket the marker was on the old trace (and is still on, on the new trace, since the bucket doesn't change).

Note this is true even if the marker is off screen. Thus, a marker that is at the center of the screen on the old trace stays at the center of the screen on the new trace. A marker that is off screen one whole screen to the left on the old trace remains off screen one whole screen to the left on the new trace – even if this means it will be at negative time!

Marker Trace is set to 1, and Auto Init is set to On, on a Preset or All Markers Off.

Auto Init Rules Flowchart

The following flowchart depicts the Auto Init rules:



This flowchart makes it clear that putting all lower-numbered traces in View is the simplest way to specify which trace you want the markers to go to when they turn on. For example, if you want all Markers to go to trace 2 when they turn on, put trace 1 in View.

Auto Init OFF

This command associates the marker with the specified trace and turns Marker Trace, Auto Init OFF for that marker. If the marker is not **Off** it moves the marker from the trace it was on to the new trace. If the marker is **Off** it stays off but is now associated with the specified trace.

The query returns the number of the trace on which the marker is currently placed, even if that marker is in Auto mode.

Remote Command:	:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe:AUTO OFF|ON|0|1 :CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe:AUTO?
Notes:	Turning Marker Trace Auto Init off has no effect on the trace on which the marker is currently placed. The response to the query will be 0 if OFF, 1 if ON.
Couplings:	The state of Auto Init is not affected by the Auto Couple key. Auto Init is set to True on a Preset or All Markers Off. If Auto Init is set to On for a marker and that marker is on, that marker's Marker Trace is immediately set according to the above flowchart. Sending the remote command causes the addressed marker to become selected.
Preset:	ON
Initial S/W Revision:	Prior to A.02.00

Lines

When on, displays a vertical line of graticule height and a horizontal line of graticule width, intersecting at the indicator point of the marker (that is, the center of the X or the bottom tip of the diamond. The lines are blue in color.

If the marker is off screen the lines should be extended from the marker so that they go thru the screen area if possible. This is really useful for off screen Fixed markers as it lets you see their amplitude even though they are off the X Axis.

Key Path	**Marker, Properties**
Remote Command	:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:LINes[:STATe] OFF|ON|0|1 :CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:LINes[:STATe]?
Example	:CALC:MARK2:LIN:ON turns Lines on for marker 2.
Couplings	Sending the remote command causes the addressed marker to become selected.
Preset	OFF
State Saved	Saved in State
Initial S/W Revision	Prior to A.02.00

Marker Table

When set to On the display is split into a measurement window and a marker data display window. For each marker which is on, information is displayed in the data display window, which includes the marker number, control mode, trace number, X axis scale, X axis value, and the Y-axis result. Additional information is shown for markers which have marker functions turned on.

Turning the Marker Table on turns the Peak Table off and vice versa.

Key Path	**Marker**
Remote Command	`:CALCulate:MARKer:TABLe[:STATe] OFF|ON|0|1` `:CALCulate:MARKer:TABLe[:STATe]?`
Example	CALC:MARK:TABL ON turns on the marker table.
Preset	OFF
State Saved	Whether the marker table is on is saved in instrument state
Initial S/W Revision	Prior to A.02.00

Marker Count

Accesses the marker count menu.

Key Path	**Marker**
Readback line	[On] if count on for the selected marker, [Off] if it is off.
Initial S/W Revision	Prior to A.02.00

Counter On/Off

Turns the marker frequency counter on and off. The selected marker is counted, and if the selected marker is a delta marker and its reference marker is not fixed, the reference marker is counted as well.

See “Understanding the Marker Counter” on page 129.

See “Query Count Value” on page 128.

Key Path	**Marker Fctn, Marker Count**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt[:STATe] OFF|ON|0|1` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt[:STATe]?`
Example	CALC:MARK2:FCO ON selects marker 2, turns it on, and turns on the counter CALC:MARK2:FCO:X? returns the counted frequency.

Notes	Fixed markers are not counted, but a Fixed marker will have a count stored in it if it is selected or is the reference marker for the selected marker. The count already in the marker is stored when the marker becomes fixed and if there is none or the marker moves (for example, Pk Search) it is counted and stored after the next sweep. If a Fixed marker has a count stored in it, that count will be displayed when the marker is selected, and used as the reference count when that marker is a reference marker. If a Fixed marker has a count stored in it, that count will be deleted if the marker X is adjusted. If a Fixed marker has a count stored in it, and a Search function is performed using the Fixed marker, while the counter is on, the count stored in the marker will be updated. If a Fixed marker has a count stored in it, and is a reference marker, and the reference is moved to a valid trace point by re-zeroing the delta (by pressing Delta again or sending the DELTa SCPI command), while the counter is on, the count stored in the marker will be updated.
Notes	This command causes the specified marker to become selected.
Dependencies	Marker Count is unavailable (grayed out and Off) if the Gate function is on.
Couplings	If the selected marker is **Off** when the counter is turned on, the selected marker is set to Normal and placed at center of screen on the trace determined by the Marker Trace rules. If a marker which is OFF is selected while the counter is on, the counter remains on, but since the marker is off, the count is undefined. In this case the analyzer will return not a number to a SCPI count query. The counter is turned OFF when the selected marker is turned OFF.
Preset	OFF
State Saved	The state of the counter (on/off) is saved in instrument state. In the case of Fixed markers, the count stored in the marker is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Query Count Value

Queries the frequency count. The query returns the absolute count unless the specified marker is in Delta mode, then it returns the relative count. If the marker is off, or the marker is on but the counter is off, the analyzer will return not a number to a SCPI count query. A marker with no stored count, or a non-**Fixed** marker on a stored trace, will also return not a number to a SCPI count query. Note this result may simply mean that the first sweep after the counter turned on has not yet completed.

Remote Command:	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt:X?`
Notes:	This query does NOT cause the specified marker to become selected.
Initial S/W Revision:	Prior to A.02.00

Understanding the Marker Counter

See "Counting Off-screen Markers" on page 129.

See "Delta Marker" on page 129.

See "Fixed Markers" on page 129.

See "More Information on "Counter"" on page 130.

Using the internal counter we can count the frequency of a marker, but we cannot count while we are actually sweeping. So, once we are done with a sweep, we move to the selected marker frequency and count that frequency. Then, if the marker is a Delta marker, the count is also taken for its reference marker. The count is actually performed by moving the LO to the frequency (or frequencies in the case of a delta marker) we wish to count. The count is executed on a marker by marker basis and no further count is taken until after the next sweep (even if the marker moves before another sweep has completed).

The Marker Count is taken by tuning the instrument to the frequency of the marker and counting the IF, with the instrument not sweeping. The count is adjusted for display by adding or subtracting it (as appropriate) from the LO frequency, so that you see a count that represents the signal frequency. This is true even if External Mixing is on. Since all this happens between sweeps, you never see the instrument retuning to do the counts.

If you wish to see the entered frequency of a counted marker it will appear in the active function area when that marker is selected (for Fixed markers, you have to press the Marker, Fixed key to select Fixed markers and then press it a second time to view or adjust the x or y marker values).

Counting Off-screen Markers

If the selected marker is off the X-axis the instrument can still be tuned to the marker (unless it is outside the range of the instrument), so the count can still be displayed. This means you can see a count for an off-screen marker even though there may be no valid Y-value for the marker. If the marker frequency is outside the range of the instrument, the display will show three dashes in the count block (---), and not a number is returned to a SCPI count query.

Delta Marker

When a Delta Marker is selected while Marker Count is on:

If the reference marker is not a fixed marker, the display shows the difference between the count of the selected marker and the count of the reference marker

If the reference marker is a fixed marker and there is a count stored in the marker (because Marker Count was on when the marker became a fixed marker), the display shows the difference between the count at the marker and the count stored in the reference marker.

Marker Count works in zero span as well as in Swept SA. The instrument tunes to the frequency of the selected marker, which, for active zero span traces, is simply the center frequency of the analyzer.

Fixed Markers

Fixed markers have a count stored in them that is generally kept fixed and not updated. If a fixed marker is selected, or used as a reference, the signal at the marker frequency is not counted; rather the stored count is seen or used as the reference. The count is stored, if Count is on, when the marker becomes fixed or when, while fixed, the marker is moved by re-zeroing the reference (if it is the reference marker) or via a peak search (since both of these, by definition, use valid trace data). The count stored in a Fixed marker is lost if the counter is turned off, if the marker is moved to an inactive trace, or if the marker is moved by adjusting its x-value.

More Information on "Counter"

When the counter is on, the count (or the delta count) for the selected marker is displayed.

The invalid data indicator (*) will turn on until the completion of the first count.

Marker Count frequency readings are corrected using the **Freq Offset** function (in some previous analyzers, they were not). Note however that Marker Delta readings are not corrected, as any offset would be applied to both.

In zero span on active traces the counter continues to function, counting any signal near the center frequency of the analyzer.

NOTE	No signal farther from the marker frequency than the Res BW will be seen by the counter.

The above command turns on or off the frequency counter. If the specified marker number in the command is not the selected marker, it becomes the selected marker. If the specified marker number is not on, FCOunt ON sets it to Normal and places it at center of screen on the trace determined by the Marker Trace rules. Once the marker count is on, it is on for any selected marker, not just for the one used in the command. A 1 is returned to the state query only if marker count is on and the specified number is the selected marker. The invalid data indicator (*) will turn on until the completion of the first count but this does not keep a value from being returned.

Gate Time Auto/Man

Controls the length of time during which the frequency counter measures the signal frequency. Longer gate times allow for greater averaging of signals whose frequency is “noisy”, though the measurement takes longer. If the gate time is an integer multiple of the length of a power-line cycle (20 ms for 50 Hz power, 16.67 ms for 60 Hz power), the counter rejects incidental modulation at the power line rate. The shortest gate time that rejects both 50 and 60 Hz modulation is 100 ms, which is the value chosen in Auto, or on Preset or when Auto Couple is pressed.

The start time of the Gate Time of the counter must be controlled by the same trigger parameters as controls the sweep. Thus, if the Trigger is not in Free Run, the counter gate must not start until after the trigger is received and delayed.

Key Path	**Marker Function, Marker Count**

Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt:GATetime <time>`
	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt:GATetime?`
	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt:GATetime:AUTO OFF|ON|0|1`
	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt:GATetime:AUTO?`

Example	:CALC:MARK2:FCO:GAT 1e–2 sets the gate time for Marker 2 to 10^(–2) s = 10 ms.
Notes	When Auto Couple is pressed, Gate Time is set to 100 ms.
Notes	This command causes the specified marker to become selected.
Preset	100 ms ON
State Saved	Saved in instrument state.
Min	1 us
Max	500 ms
Initial S/W Revision	Prior to A.02.00

Couple Markers

When this function is true, moving any marker causes an equal X Axis movement of every other marker which is not Fixed or Off. By “equal X Axis movement” we mean that we preserve the difference between each marker’s X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

Note that Fixed markers do not couple. They stay where they were while all the other markers move. Of course, if a Fixed marker is being moved, all the non-fixed markers do move with it.

This may result in markers going off screen.

Key Path	**Marker**
Remote Command	`:CALCulate:MARKer:COUPle[:STATe] OFF|ON|0|1` `:CALCulate:MARKer:COUPle[:STATe]?`
Example	:CALC:MARK:COUP ON sets Couple Markers on.
Preset	Off, presets on Mode Preset and All Markers Off
State Saved	Saved in State
Initial S/W Revision	Prior to A.02.00

All Markers Off

Turns off all markers. See Marker, “Off ” on page 119.

Key Path	**Marker**
Remote Command	:CALCulate:MARKer:AOFF
Example	CALC:MARK:AOFF turns off all markers.
Couplings	sets the selected marker to 1.
Preset	n/a.
Initial S/W Revision	Prior to A.02.00

Marker Function

The Marker Function key opens up a menu of softkeys that allow you to control the Marker Functions of the instrument. Marker Functions perform post-processing operations on marker data. Band Functions are Marker Functions that allow you to define a band of frequencies around the marker. The band defines the region of data used for the numerical calculations. These marker functions also allow you to perform mathematical calculations on trace and marker data and report the results of these calculations in place of the normal marker result.

NOTE Unlike regular markers, marker function markers are not placed directly on the trace. They are placed at a location which is relative to the result of the function calculation.

See “More Information” on page 133.

See “Fixed marker functions” on page 133.

See “Interval Markers” on page 133.

Remote Command:	:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion NOISe|BPOWer|BDENsity|OFF :CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion?
Notes:	Sending this command selects the subopcoded marker The marker function result is queried in the same fashion as the Marker Result, as outlined in the Marker section, with the CALC:MARK:Y? command.
Dependencies:	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys are grayed out for a Fixed marker. If a marker function was already on when the marker became Fixed then the selected Band Function is shown but cannot be changed. Therefore, you cannot directly set the X or Y value of a Fixed marker which has a marker function turned on. To turn off the function, turn off the marker.

Preset:	OFF
State Saved:	The band function for each marker is saved in Instrument State
Initial S/W Revision:	Prior to A.02.00

More Information

The units to be used for displaying Marker Function results in Delta mode vary depending on what is the reference marker and what it is referenced to.

Marker Functions are different from Measurements, which automatically perform complex sequences of setup, data acquisition, and display operations in order to measure specified signal characteristics. Marker Functions are specified for each individual marker and may be turned on individually for each marker.

The **Marker Fctn** menu controls which marker functions are turned on and allows you to adjust setup parameters for each function. The Marker Functions are **Marker Noise**, **Band/Interval Power**, and **Band/Interval Density,** only one of which can be on for a given marker.

If the selected marker is off, pressing Marker Fctn sets it to Normal and places it at the center of the display on the trace determined by the Marker Trace rules. However, if the selected marker was **Off**, **Marker Function Off** had to be the selected function, and it remains so even after the marker is thus turned on, although you may then change it.

Fixed marker functions

In the case of a fixed marker, it is not possible to turn on or change a band function. This is because a Fixed marker holds the value it had when it became fixed; the trace it was on may keep on changing, so the function value, which depends on trace data, could not be calculated on an ongoing basis.

It is possible to have a Marker Function on for a Fixed marker, in the case where a function was already on when the marker became Fixed. In this case the function value will be retained in the marker. It is also possible to have a Marker Function on for a Fixed marker in the case when the marker was off and was turned on as **Fixed** because **Delta** was pressed to create a reference marker - in which case the marker function, marker function width, Y Axis value and marker function result that the **Delta** marker had when **Delta** was pressed are copied into the Fixed marker. If **Delta** is pressed again, causing the fixed reference marker to move to the delta marker's position, the marker function, marker function width, Y Axis value and marker function result that the **Delta** marker had when **Delta** was pressed are again copied into the fixed reference marker.

If a Marker Function is on for a Fixed marker, the marker's reported value is derived by the function. Therefore you cannot directly set the X or Y value of a Fixed marker which has a marker function turned on. Indirect setting as detailed above or when a Peak Search is performed is allowed, as the Fixed marker is always placed on a trace and can derive its function value from the trace at the moment when it is placed.

Interval Markers

What is an interval marker? The band power marker computes the total power within a span in a nonzero span. The results computation must include the RBW. The interval power marker measures the average power across some time interval in zero span.

Interval Density is defined to be Interval Power divided by Bn. Bn is the noise bandwidth of the RBW filter, as noted and used within the Band Power computation.

Select Marker

See “Select Marker ” on page 1574.

Marker Noise

Turns on the Marker Noise function for the selected marker, making it a noise marker. If the selected marker is off, it is turned on in **Normal** mode and located at the center of the screen.

When **Marker Noise** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

When **Marker Noise** is on, the marker’s Y Axis Result is the average noise level, normalized to a 1 Hz noise power bandwidth, in the band specified under the **Band Adjust** key.

See “More Information” on page 134.

See “Off-trace Markers” on page 135.

Key Path	**Marker Fctn**
Example	CALC:MARK:FUNC NOIS turns on marker 1 as a noise marker. CALC:MARK:FUNC? returns the current marker function for the marker specified. In this case it returns the string: NOIS. CALC:MARK:Y? returns the y-axis value of the Marker Noise function for marker 1 (if Marker Noise is ON for marker 1). Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be 0.22 = 0.04. When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power (W).
Notes	See the description under the ““Marker Function” on page 132**”** key, above.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	Average detector and Power Averaging auto selected when Marker Noise on If the selected (specified) marker is off, selecting Marker Noise via front panel or SCPI will turn the marker on.
Initial S/W Revision	Prior to A.02.00

More Information

To guarantee accurate data for noise-like signals, a correction for equivalent noise bandwidth is made by the analyzer. The **Marker Noise** function accuracy is best when the detector is set to Average or Sample, because neither of these detectors will peak-bias the noise. The trade off between sweep time and variance of the result is best when Average Type is set to Power Averaging. Therefore, Auto coupling chooses the Average detector and Power Averaging when Marker Noise is on. Though the Marker Noise function works with all settings of detector and Average Type, using the positive or negative peak detector gives less accurate measurement results.

Off-trace Markers

If a **Normal** or **Delta** noise marker is so near to the left or right edge of the trace that some of the band is off the trace, then it uses only that subset of the Band Width that is on-trace. If the marker itself is off-trace, its value becomes undefined.

Neither band/interval power nor band/interval density markers are defined if any part of the band is off-trace (unless they are Fixed with a stored function value in them), except that when the edges of the bandwidth are trivially off-screen, due to mathematical limitations in the analyzer or in the controlling computer, the result will still be considered valid.

Band/Interval Power

Turns on the Band/Interval Power function for the selected marker. If the selected marker is off it is turned on in **Normal** marker and located at the center of the screen.

When **Band/Interval Power** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

If the detector mode for the detector on the marker's trace is set to Auto, the average detector is selected. If the Average type is set to Auto, Power Averaging is selected. Other choices for the detector or Average type will usually cause measurement inaccuracy.

Key Path	**Marker Fctn**
Example	CALC:MARK:FUNC BPOW turns on marker 1 as a band power marker. CALC:MARK2:FUNC? returns the current setting of marker function for marker 2. In this case it returns the string: BPOW. CALC:MARK:Y? returns the y-axis value of the Band Power function for marker 1. Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be 0.22 = 0.04. When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power (W).
Notes	See the description under the ""Marker Function" on page 132**"** key, above.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	If the detector mode for the detector on the marker's trace is set to Auto, the average detector is selected. If the Average type is set to Auto, Power Averaging is selected. If the selected (specified) marker is off, selecting Band Power via front panel or SCPI will turn the marker on.
Initial S/W Revision	Prior to A.02.00

Band/Interval Density

Turns on the Band/Interval Density function for the selected marker. If the selected marker is off it is turned on in **Normal** marker mode and located at the center of the screen.

When **Band/Interval Density** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

See "More Information" on page 136.

See "What is band/interval density? " on page 137

Key Path	**Marker Fctn**
Example	CALC:MARK:FUNC BDEN turns on marker 1 as a band density marker. CALC:MARK:FUNC? returns the current setting of band function for the marker specified. In this case it returns the string: BDEN. CALC:MARK:Y? returns the y-axis value of the Band Density function for marker 1. Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be 0.22 = 0.04. When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power (W).
Notes	The zero-width case is treated as one bucket wide although it shows a width of 0. When the trace the marker is on crosses domains, the width crosses domains as well, to remain the same percentage of the trace
Notes	See the description under the ""Marker Function" on page 132**"** key, above.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	If the detector mode for the detector on the marker's trace is set to Auto, the average detector is selected. If the Average type is set to Auto, Power Averaging is selected. If the selected (specified) marker is off, selecting Band Density via front panel or SCPI will turn the marker on.
State Saved	n/a.
Initial S/W Revision	Prior to A.02.00

More Information

It may seem like the band density marker function is exactly like a function of a noise marker with variable width. But they are somewhat different. The Noise markers assume that the signal to be measured is noise-like. Based on this assumption, we can actually make reasonable measurements under very nonideal conditions: any detector may be used, any averaging type, any VBW. In contrast, the Band Power and Band Density markers make no assumption about the statistics of the signal.

If the detector mode for the detector on the marker's trace is set to Auto, the average detector is selected. If the Average type is set to Auto, Power Averaging is selected. Other choices for the detector or Average type will usually cause measurement inaccuracy.

What is band/interval density?

On frequency domain traces, the average density across a band is the total band power divided by the bandwidth over which it is measured.

On time domain traces, interval density is the average power in the interval divided by the noise bandwidth of the RBW of the trace.

Off

Turns off band functions for the selected marker.

Key Path	**Marker, Marker Fctn**
Example	:CALC:MARK:FUNC OFF turns off marker functions for marker 1
Notes	See the description under the “Marker” on page 1571 key.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys are grayed out for a Fixed marker, including Off
Couplings	Turning off the marker function has no effect on the band span nor does it turn the marker off.
Initial S/W Revision	Prior to A.02.00

Band Adjust

Opens a menu that lets you set the width or left or right edges of the band.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

Key Path	**Marker Function**
Dependencies	If the marker is Fixed, Band Adjust is grayed out. If the marker function is Off, Band Adjust is grayed out.
Couplings	If any of the Band Adjust functions are the active function, the wings and arms of the selected marker display in green; otherwise they display in white.
Initial S/W Revision	Prior to A.02.00

Band/Interval Span

Sets the width of the span for the selected marker.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

In the table below, sweep_width = max(1,sweep_points–1) and sweep_points is the number of sweep points, set in the **Sweep** menu.

Key Path	**Marker Fctn, Band Adjust**

Remote Command	:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:SPAN <freq> :CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:SPAN?
Example	:CALC:MARK12:FUNC:BAND:SPAN 20 MHz sets the band span of marker 12 to 20 MHz :CALC:MARK:FUNC:BAND:SPAN? queries the band span of Marker 1
Notes	Units are those of the trace's domain, Hz for frequency domain, s for time domain.
Notes	Sending this command selects the subopcoded marker The unit of the parameter must match the current domain of the trace the selected marker is on, or an invalid suffix error will be generated. If no unit is sent the fundamental unit for the trace domain will be used (Hz for freq domain traces, s for time domain traces). Note that all the values provided in this table are only valid for frequency domain traces. If the current domain of the trace is time domain, values and unit will be different. In frequency domain, the Preset value is dependant on the frequency range of the instrument. The default value 1.3245 GHz is appropriate only if the instrument is a 26.5 GHz instrument (Option 526). In a 26.5 GHz Instrument, the default span is 26.49 GHz, so 5% of the span corresponds to 1.3245 GHz.
Couplings	Changing the Band/Interval Span necessarily changes the Band/Interval Left and Band/Interval Right values Band/Interval Span is set to 0 when the marker is turned off Band/Interval Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time
Preset	If 0, set to 5% of span, when a marker function is turned on
State Saved	Saved in Instrument State
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
Backwards Compatibility SCPI	:CALCulate:MARKer[1]|2|3|4:X:SPAN
Initial S/W Revision	Prior to A.02.00

Band/Interval Left

Sets the left edge frequency or time for the band of the selected marker. The right edge is unaffected.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

In the table below, sweep_width = max(1,sweep_points–1) and sweep_points is the number of sweep points, set in the **Sweep** menu.

Key Path	**Marker Fctn, Band Adjust**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:LEFT <freq>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:LEFT?`
Example	:CALC:MARK12:FUNC:BAND:LEFT 20 GHz sets the left edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:LEFT? queries the band span of Marker 1
Notes	Units are those of the trace’s domain, Hz for frequency domain, s for time domain. When the left edge is moved, the right edge stays anchored; thus, the marker’s frequency will change.
Notes	Sending this command selects the subopcoded marker The unit of the parameter must match the current domain of the trace the selected marker is on, or an invalid suffix error will be generated.If no unit is sent the fundamental unit for the trace domain will be used (Hz for freq domain traces, s for time domain traces). Note that all the values provided in this table are only valid for frequency domain traces. If the current domain of the trace is time domain, values and unit will be different. In frequency domain, the Preset value is dependant on the frequency range of the instrument. The default value 1.3245 GHz is appropriate only if the instrument is a 26.5 GHz instrument (Option 526). In a 26.5 GHz Instrument, the default span is 26.49 GHz, so 5% of the span corresponds to 1.3245 GHz.
Couplings	Changing the Band/Interval Left necessarily changes the Band/Interval Span and Band/Interval Center values Band/Interval Span is set to 0 when the marker is turned off so that means Band/Interval Left is set to the center value at this time Band/Interval Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time
Preset	If 0, Band/Interval Span is set to 5% of span, when a marker function is turned on, which affects Band/Interval Left
State Saved	Saved in Instrument State
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
Backwards Compatibility SCPI	:CALCulate:MARKer[1]|2|3|4:X:STARt (This legacy command was used to control the Reference marker in Delta Pair/Band Pair mode, and is aliased to the new command.)
Initial S/W Revision	Prior to A.02.00

Band/Interval Right

Sets the right edge frequency or time for the band of the selected marker. The left edge is unaffected

In the table below, sweep_width = max(1,sweep_points–1) and sweep_points is the number of sweep points, set in the **Sweep** menu.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

Key Path	**Marker Fctn, Band Adjust**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:RIGHt <freq>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:RIGHt?`
Example	:CALC:MARK12:FUNC:BAND:RIGHt 20 GHz sets the right edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:RIGHt? queries the band span of Marker 1
Notes	Units are those of the trace’s domain, Hz for frequency domain, s for time domain. When the right edge is moved, the left edge stays anchored; thus, the marker’s frequency will change.
Notes	Sending this command selects the subopcoded marker The unit of the parameter must match the current domain of the trace the selected marker is on, or an invalid suffix error will be generated. If no unit is sent the fundamental unit for the trace domain will be used (Hz for freq domain traces, s for time domain traces). Note that all the values provided in this table are only valid for frequency domain traces. If the current domain of the trace is time domain, values and unit will be different. In frequency domain, the Preset value is dependant on the frequency range of the instrument. The default value 1.3245 GHz is appropriate only if the instrument is a 26.5 GHz instrument (Option 526). In a 26.5 GHz Instrument, the default span is 26.49 GHz, so 5% of the span corresponds to 1.3245 GHz.
Couplings	Changing the Band/Interval Right necessarily changes the Band/Interval Span and Band/Interval Center values Band/Interval Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time
Preset	If 0, Band/Interval Span is set to 5% of span, when a marker function is turned on, which affects Band/Interval Right
State Saved	Saved in Instrument State
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

Backwards Compatibility SCPI	:CALCulate:MARKer[1]|2|3|4:X:STOP (This legacy command was used to control the Delta marker in Delta Pair/Band Pair mode, and is aliased to the new command. For compatibility. Note that if you were using the old command for Band Power measurements it will work just fine.)
Initial S/W Revision	Prior to A.02.00

Measure at Marker

This key and all the keys in this menu only appear with Option EMC installed and licensed.

This key opens up a menu which contains the Measure at Marker functions. This key only appears with option EMC installed.

Key Path	**Marker Function**
Initial S/W Revision	A.02.00

Measure at Marker

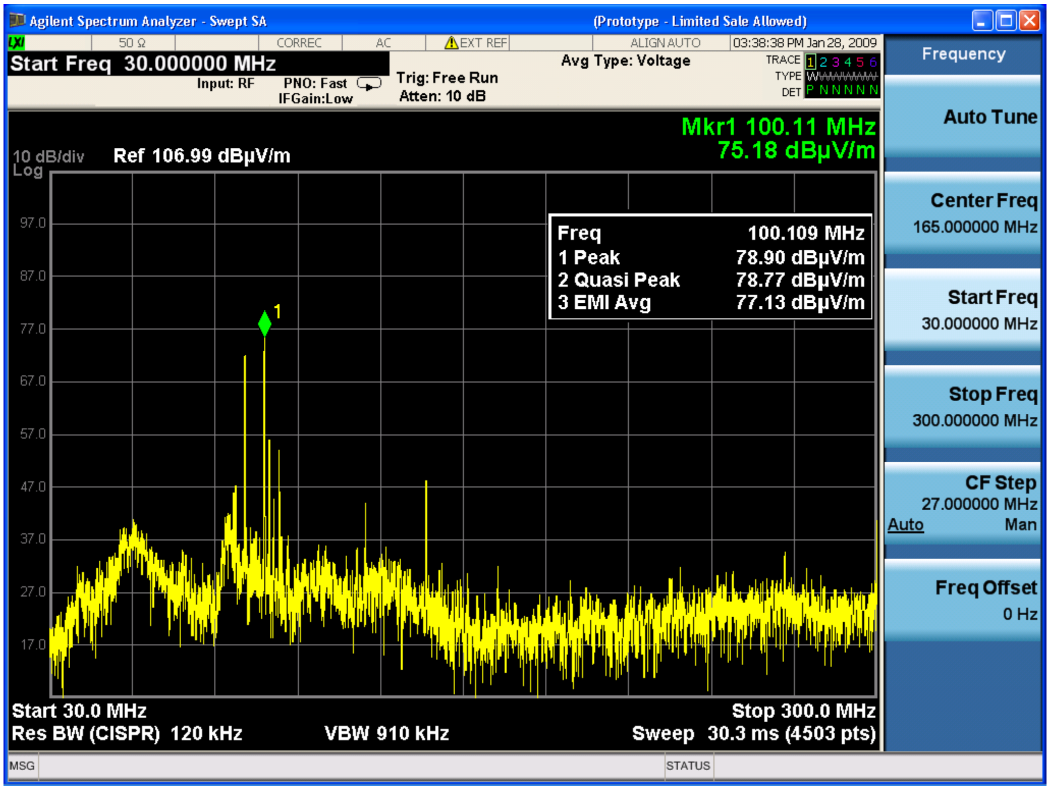
When this key is pressed, the analyzer executes one Measure at Marker function and then returns. Measure at Marker goes to the frequency of the selected marker and takes a reading with each of the three detectors selected in the Detectors menu, using the dwell times specified there, then displays the readings in a window on the display, using the current Y-Axis Unit.

When the Measure at Marker is complete, the analyzer restores all settings to their pre-Measure-at-Marker values and normal sweeps resume.

Key Path	**Marker Function, Measure at Marker**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:MAMarker?`
Example	:CALC:MARK2:FUNC:MAM? Performs a Measure at Marker function at Marker 2’s current frequency and, when completed, returns the results of the measure at marker window in a query

Notes	This query command returns comma separated values for the 3 specified detectors and the frequency value of the marker. If a Detector is off or if no measurement has yet completed, –999.0 will be returned. This can happen, for example, if you are operating with too large a value of (span/sweep points) and the Measure at Marker function does not execute but instead puts up the advisory message, “Span per point too large, narrow span or increase RBW or number of points” (see below). The size of the return data array is fixed at 4. The elements are: 1. Detector 1 value (if off, –999.0 for backwards compatibility) 2. Detector 2 value (if off, –999.0 for backwards compatibility) 3. Detector 3 value (if off, –999.0 for backwards compatibility) 4. Frequency of Marker If a sweep is in process when this function executes it aborts, and restarts after the function is complete. This command is not backwards compatible with the E7400 and PSA option 239 so the Backwards Compatibility command is included.
Dependencies	If **BW & Avg Type** is in Autocoupled state, the (up to three) measurements taken by Measure at Marker are taken with Auto Coupled settings for the functions in the BW menu, even if those functions are in manual.
Couplings	If the specified Marker is not on, the analyzer turns it on at center of screen and does a peak search before performing the function.
Status Bits/OPC dependencies	OPC goes true when the measurement is complete
Backwards Compatibility SCPI	:MEASure:EMI:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12? (Performs a Measure at Marker function at specified marker’s current frequency and returns the results)
Initial S/W Revision	A.02.00

Measure at Marker presents its information in a separate window which normally appears in the upper right of the display but can be repositioned to the upper left.



The Measure at Marker box shows the detector name for the selected detectors and “Off” for those not selected. The names used are:

Name	**Detector**
Normal	Normal
Peak	Peak
Sample	Sample
Neg Peak	Negative Peak
RMS	Average detector with Power Average (RMS)
Log Avg	Average detector with Log-Pwr Average
VoltageAvg	Average detector with Voltage Average
Quasi Peak	Quasi Peak
EMI Avg	EMI Average
RMS Avg	RMS Average

The marker frequency is shown in the “Freq” field. The measured value is shown for all detectors except those that are “Off.” For these, --- is displayed. The current Y-Axis unit is used, and the precision that is used for the detector value displays is exactly the same as for the Marker The precision used for the Frequency display is six significant digits.

The sequence of steps in the measurement is as follows:

- Any sweep in progress is aborted.
- If in Zero Span, the Center Frequency is used as the frequency at which to take the reading, since in Zero Span, all markers are by definition at the Center Frequency
- If not in Zero Span:
  — If the selected marker is Off, it is first turned on in the center of the screen and a peak search performed.
  — If the selected marker is on, but offscreen, it is first moved to the center of the screen and a peak search performed. .
  — A frequency "zoom" function is performed to determine the frequency of the selected marker to the required precision. If you are operating with too large a value of (span/sweep points) then the Measure at Marker window will not display, but instead an advisory message, "Span per point too large, narrow span or increase RBW or number of points".This means you have chosen a combination of RBW, span and sweep points that makes each trace point much wider than the RBW, so that the trace point in which the signal appears is an inadequately precise measure of its frequency—for example, with a 30 MHz to 1000 MHz span, 601 trace points and 120 kHz RBW, each trace point is 13 times as wide as the RBW. In this case, a SCPI query of the results will yield –999 dBm for each detector.
  — If the zoom is successful, the analyzer goes to zero span at this frequency
- Each detector is then read in successive single-point zero span sweeps, using a sweep time equal to the specified dwell time. The value displayed by Measure at Marker represents the maximum value output by the detector during the dwell timeAutocoupled bandwidth and average type settings are used for each detector unless the **BW & Avg Type** key is set to **As Set**, in which case the current bandwidth and average type settings are used.
- Each result is then displayed in the measure at marker window as it becomes available.
- The analyzer returns to its pre-Measure at Marker span and settings after executing a Measure at Marker function, including Bandwidth, Avg Type, and EMC Std - regardless of the setting of **BW & Avg Type**
- Finally, if the sweep had to be aborted, the aborted sweep is restarted.

While the function is executing, all the fields except Freq show --- for their values until the measurement is complete for that detector.   As each detector is read, an informational message is displayed in the status line, for example,

Measuring with detector 1 (Peak) with RBW=120 kHz

After the last detector, the status line is cleared.

Meas at Marker Window

This key opens a menu which controls the Measure at Marker window.

Key Path	**Marker Function, Measure at Marker**
Readback	In square brackets, the state of the window then the window position, separated by commas, as [On, Left]

Initial S/W Revision	A.02.00

Window On/Off

This key turns the Measure at Marker window on and off. It turns on automatically when Measure at Marker is initiated and turns off on a Preset. If the Window is turned on without a Measure at Marker result, --- is displayed for each result for which the detector is not "Off".

Key Path	**Marker Function, Measure at Marker, Meas at Marker Window**
Remote Command	`:DISPlay:WINDow:MAMarker[:STATe] ON|OFF|1|0` `:DISPlay:WINDow:MAMarker[:STATe]?`
Example	:DISP:WIND:MAM ON
Couplings	The window turns on automatically when Measure at Marker is initiated and turns off on a Preset.
Preset	Off
State Saved	Saved in state
Readback Text	On|Off
Initial S/W Revision	A.02.00

Position Left/Right

This key controls the placement of the Measure at Marker window on the display.

Key Path	**Marker Function, Measure at Marker, Meas at Marker Window**
Remote Command	`:DISPlay:WINDow:MAMarker:POSition LEFT|RIGHt` `:DISPlay:WINDow:MAMarker:POSition?`
Example	:DISP:WIND:MAM:POS RIGH
Preset	Right
State Saved	Saved in state
Readback Text	Left|Right
Initial S/W Revision	A.02.00

Detectors

This key opens up a menu that allows you to configure the detectors to be used for the Measure at Marker reading. Any of the analyzer's detectors can be used for each of the three detectors, or any of the three can be turned off. The dwell time for each detector is also settable.

When performing a Meas at Marker, the dwell time settings that you select will depend on the characteristics of the emission you are measuring. The default dwell time (200 ms) should work well for typical EUT emissions, but sometimes you will encounter emissions for which the defaults are not optimal. This is especially the case for emissions that vary slowly over time or have a slow repetition rate. By lengthening the dwell times you can increase the likelihood of accurately measuring these low repetition rate signals.

When Measure at marker is activated, the receiver makes a zero span measurement for each of the (up to) three detectors selected, using the Dwell Time set for each detector. If the signal's repetition period is greater than 200 ms (the default setting), the dwell time should be increased to capture at least two and preferably more repetitions of the signal. Additionally, if you do not need or do not wish to use a detector to make a measurement, that specific detector may be turned off.

If the Measure at Marker window is being displayed, and one of the detectors is changed, any value being displayed for that detector changes to “---“ until the next successful reading from that detector.

Key Path	**Marker Function, Measure at Marker,**
Remote Command	`:CALCulate:MAMarker:DETector[1]|2|3 OFF|NORMal|AVERage|POSitive|SAMPle|NEGative|QPEak|EAVerage|RAVerage` `:CALCulate:MAMarker:DETector[1]|2|3?`
Example	:CALC:MAM:DET2 QPE Sets the detector for measure at marker detector 2 to Quasi peak :CALC:MAM:DET OFF Sets the detector for measure at marker detector 1 to Off
State Saved	Saved in state
Initial S/W Revision	A.02.00

Key Path	**Marker Function, Measure at Marker,**
Remote Command	`:CALCulate:MAMarker:DETector[1]|2|3:DWELl <dwell time>` `:CALCulate:MAMarker:DETector[1]|2|3:DWELl?`
Example	:CALC:MAM:DET2:DWEL 500 ms Sets the detector for measure at marker detector 2 to dwell for 500 ms
State Saved	Saved in state
Backwards Compatibility SCPI	[:SENSe]:EMI:MEASure:DETector:DWELl <dwell time> ! Sets all of the detectors dwell time to the specified amount
Initial S/W Revision	A.02.00

Detector 1

This menu lets you select the detector to be used for Detector 1, or turn Detector 1 off. This is a 1-of-N menu that shows the normal list of detectors, but with the “Auto” key replaced by “Off”.

Key Path	**Marker Function, Measure at Marker, Detectors**
Remote Command	See “Detectors” on page 145.

Example	:CALC:MAM:DET QPE Sets the detector for measure at marker detector 1 to Quasi peak :CALC:MAM:DET OFF Sets the detector for measure at marker detector 1 to Off
Preset	Peak
State Saved	Saved in state
Readback Text	Detector name
Initial S/W Revision	A.02.00

Detector 2

This menu lets you select the detector to be used for Detector 2, or turn Detector 2 off. This is a 1-of-N menu that shows the normal list of detectors, but with the “Auto” key replaced by “Off”.

Key Path	**Marker Function, Measure at Marker, Detectors**
Remote Command	See “Detectors” on page 145.
Example	:CALC:MAM:DET2 QPE Sets the detector for measure at marker detector 2 to Quasi peak :CALC:MAM:DET2 OFF Sets the detector for measure at marker detector 2 to Off
Preset	Quasi Peak
State Saved	Saved in state
Readback Text	Detector name
Backwards Compatibility SCPI	[:SENSe]:EMI:MEASure:DETector:QPEak[:STATe] OFF|ON|0|1| ! If sent with On as a parameter, sets detector 2 to Quasi Peak ! If sent with Off as a parameter, sets detector 2 to Off
Initial S/W Revision	A.02.00

Detector 3

This menu lets you select the detector to be used for Detector 3, or turn Detector 3 off. This is a 1-of-N menu that shows the normal list of detectors, but with the “Auto” key replaced by “Off”.

Key Path	**Marker Function, Measure at Marker, Detectors**
Remote Command	See “Detectors” on page 145.

Example	:CALC:MAM:DET3 QPE Sets the detector for measure at marker detector 1 to Quasi peak :CALC:MAM:DET3 OFF Sets the detector for measure at marker detector 1 to Off
Preset	EMI Average
State Saved	Saved in state
Readback Text	Detector name
Backwards Compatibility SCPI	[:SENSe]:EMI:MEASure:DETector:AVERage[:STATe] OFF|ON|0|1| ! If sent with On as a parameter, sets detector 3 to EMI Average ! If sent with Off as a parameter, sets detector 3 to Off
Initial S/W Revision	A.02.00

Detector 1 Dwell Time

This is the time specified by the user to dwell while taking the measurement for detector 1. The minimum allowed dwell time is based on the current detector If "Off" is selected for detector 1, this key is grayed out and shows 200 ms.

Key Path	**Marker Function, Measure at Marker, Detectors**
Remote Command	See "Detectors" on page 145.
Example	:CALC:MAM:DET:DWEL 400 ms Sets the dwell time for detector 1 to 400 ms
Preset	200 ms
State Saved	Saved in state
Min	1 ms
Max	60 s
Default Unit	s
Initial S/W Revision	A.02.00

Detector 2 Dwell Time

This is the time specified by the user to dwell while taking the measurement for detector 2. The minimum allowed dwell time is based on the current detector. If "Off" is selected for detector 2, this key is grayed out and shows 200 ms.

Key Path	**Marker Function, Measure at Marker, Detectors**
Remote Command	See "Detectors" on page 145.
Example	:CALC:MAM:DET2:DWEL 400 ms Sets the dwell time for detector 2 to 400 ms

Preset	200 ms
State Saved	Saved in state
Min	1 ms
Max	60 s
Default Unit	s
Initial S/W Revision	A.02.00

Detector 3 Dwell Time

This is the time specified by the user to dwell while taking the measurement for detector 3. The minimum allowed dwell time is based on the current detector. If “Off” is selected for detector 3, this key is grayed out and shows 200 ms.

Key Path	**Marker Function, Measure at Marker, Detectors**
Remote Command	See “Detectors” on page 145.
Example	:CALC:MAM:DET3:DWEL 400 ms Sets the dwell time for detector 1 to 400 ms
Preset	200 ms
State Saved	Saved in state
Min	1 ms
Max	60 s
Default Unit	s
Initial S/W Revision	A.02.00

BW & Avg Type

This key controls the type of bandwidth and average type coupling used in Measure at Marker.

If set to “Autocoupled”, then the RBW and Average Type are selected by the instrument during the Measure at Marker function, according to the normal Autocouple rules, regardless of whether RBW and Average Type are currently in Auto. If set to “As Set”, then the current value for RBW and Average Type are used (which of course, could also be “Auto”).

Here are the details of the two modes:

If **BW & Avg Type** is set to **Autocoupled**, **Measure at Marker** behaves as follows:

1) The **EMC Std** changes to CISPR if any of the CISPR detectors (EMI Avg, RMS Avg, QPD) becomes selected; for all other detectors, the value of **EMC Std** that existed before Measure at Marker is used.

2) **RBW** autocouples throughout Measure at Marker, even if **RBW** is set to **Manual.** The autocouple rules are based on whatever the instantaneous setting of EMC Std, Span, and Center Freq are.

If **BW & Avg Type** is set to **As Set**, **Measure at Marker** behaves as follows:

1) The **EMC Std** never changes; so if it is set to **None** it stays at **None** throughout, even if one of the CISPR detectors is selected.

2) If **RBW** is set to **Auto**, then **RBW** autocouples throughout Measure at Marker. The autocouple rules are based on whatever the setting of EMC Std, Span, and Center Freq are.

3) If **RBW** is set to **Manual**, the RBW never changes at all throughout Meaure at Marker, it stays at the value to which it was set before Measure at Marker began.

The analyzer returns to its pre-Measure at Marker span and settings after executing a Measure at Marker function, including Bandwidth, Avg Type, and EMC Std.

It is important to note that, when RBW is coupled to Frequency, as it is when **EMC Std** is anything but "None", for all EMI measurements, the frequency it is coupled to for Measure at Marker is the MARKER frequency, not the Center Frequency.

Key Path	**Marker Function, Measure at Marker**
Remote Command	`:CALCulate:MAMarker:COUPling ON|OFF|1|0` `:CALCulate:MAMarker:COUPling?`
Example	:CALC:MAM:COUP ON
Preset	Autocoupled
State Saved	Saved in state
Readback Text	Autocoupled|As Set
Initial S/W Revision	A.02.00

Center Presel On/Off

This key controls the automatic centering of the preselector for the Measure at Marker function.

When Center Presel is On, the first step in performing the Measure at Marker function is to perform a Presel Center. This is not performed if the microwave preselector is off, or the selected marker's frequency is below Band 1. If the function is not performed, no message is generated.

Remote Command	`:CALCulate:MAMarker:PCENter ON|OFF|1|0` `:CALCulate:MAMarker:PCENter?`
Example	:CALC:MAM:PCEN ON
Initial S/W Revision	A.02.00
Key Path	**Marker Function, Measure at Marker**
Dependencies	Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.
Preset	On

Backwards Compatibility SCPI	[:SENSe]:EMI:MEASure:PCENter[:STATe] OFF|ON|0|1 [:SENSe]:EMI:MEASure:PCENter[:STATe]?

Marker To

The Marker -> key accesses menu keys that can copy the current marker value into other instrument parameters (for example, Center Freq). The currently selected marker is made the active function on entry to this menu (if the currently selected marker is not on when you press this front panel key, it will be turned on at the center of the screen as a normal type marker and then made the active function).

The **Marker ->** (or Marker To) feature is used to quickly assign a marker's x- or y-axis value to another parameter. For example, if a marker's x-axis value is 500 MHz and y-axis value is –20 dBm, pressing **Mkr -> CF** would assign 500 MHz to **Center Freq** and pressing **Mkr - >Ref Lvl** would assign –20 dBm to **Ref Level**.

Notes	All Marker To functions executed from the front panel use the selected marker's values, while all Marker To remote commands specify in the command which marker's value to use. Consistent with other remote marker commands, sending a Marker To remote command will never change which marker is selected.
Initial S/W Revision	Prior to A.02.00

Mkr->CF

Sets the center frequency of the analyzer to the frequency of the selected marker. The marker stays at this frequency, so it moves to the center of the display. In delta marker mode, this function sets the center frequency to the x-axis value of the delta marker. When the frequency scale is in log mode, the center frequency is not at the center of the display.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker ->**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:CENTer`
Example	CALC:MARK2:CENT sets the CF of the analyzer to the value of marker 2.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Center Frequency apply (see the Frequency Section).
Initial S/W Revision	Prior to A.02.00

Mkr->CF Step

Sets the center frequency (CF) step size of the analyzer to the marker frequency, or in a delta-marker mode, to the frequency difference between the delta and reference markers.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker ->**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:STEP`
Example	CALC:MARK1:STEP sets the CF step to the value (or delta value) of marker 1.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting CF Step apply (see the Frequency Section).
Initial S/W Revision	Prior to A.02.00

Mkr->Start

Changes the start frequency to the frequency of the selected marker. The marker stays at this frequency, so it moves to the left edge of the display. In delta marker mode, this function sets the start frequency to the x-axis value of the delta marker.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker ->**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:STARt`
Example	CALC:MARK1:STAR sets the start frequency to the value (or delta value) of marker 1.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Start Frequency apply (see the Frequency Section).

Initial S/W Revision	Prior to A.02.00

Mkr->Stop

Changes the stop frequency to the frequency of the selected marker. The marker stays at this frequency, so it moves to the right edge of the display. In delta marker mode, this function sets the stop frequency to the x-axis value of the delta marker.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker ->**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:STOP`
Example	CALC:MARK3:STOP sets the stop frequency to the value (or delta value) of marker 3.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Stop Frequency apply (see the Frequency Section).
Initial S/W Revision	Prior to A.02.00

MkrΔ->Span

Sets the start and stop frequencies to the values of the delta markers. That is, it moves the lower of the two marker frequencies to the start frequency and the higher of the two marker frequencies to the stop frequency. The marker mode is unchanged and the two markers (delta and reference) end up on opposite edges of the display.

Key Path	**Marker ->**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:DELTa:SPAN`
Example	CALC:MARK2:DELT:SPAN sets the start and stop frequencies to the values of marker 2 and its reference marker.
Notes	Sending this command selects the subopcoded marker
Dependencies	This function is only available when the selected marker is a delta marker. Otherwise the key is grayed out. In addition, this function is not available when x-axis is the time domain
Couplings	All the usual couplings associated with setting Span apply (see the Section "“SPAN X Scale” on page 1473”).

Backwards Compatibility SCPI	:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:SPAN
Initial S/W Revision	Prior to A.02.00

MkrΔ->CF

Sets the center frequency to the frequency difference between the selected marker and its reference marker. The marker is then changed to a Normal marker and placed at the center of span.

Key Path	**Marker ->**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:DELTa:CENTer`
Example	CALC:MARK2:CENT sets the CF of the analyzer to the value of marker 2.
Notes	Sending this command selects the subopcoded marker
Dependencies	This function is only available when the selected marker is a delta marker. Otherwise the key is grayed out. In addition, this function is not available when x-axis is the time domain
Initial S/W Revision	Prior to A.02.00

Mkr->Ref Lvl

Sets the reference level to the amplitude value of the selected marker, moving the marked point to the reference level (top line of the graticule). The marker's mode (Normal, Delta, Fixed) doesn't matter in this case. For example, given a delta marker, if the delta marker is the selected marker, its amplitude is applied to the reference level. If the reference marker is selected, its amplitude is applied to the reference level.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the reference level.

Key Path	**Marker ->**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:SET]:RLEVel`
Example	CALC:MARK2:RLEV sets the reference level of the analyzer to the amplitude of marker 2.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Couplings	All the usual couplings associated with setting Reference Level apply.
Initial S/W Revision	Prior to A.02.00

Meas

The information in this section is common to all measurements. For key and remote command information for a specific measurement, refer to the section that describes the measurement of interest.

Measurements available under the Meas key are specific to the current Mode.

When viewing Help for measurements, note the following:

NOTE	Operation for some keys differs between measurements. The information displayed in Help pertains to the current measurement. To see how a key operates in a different measurement, exit Help (press the Cancel Esc key), select the measurement, then reenter Help (press the Help key) and press that key.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Remote Measurement Functions

This section contains the following topics:

"Measurement Group of Commands" on page 156

"Current Measurement Query (Remote Command Only) " on page 158

"Limit Test Current Results (Remote Command Only)" on page 159

"Data Query (Remote Command Only)" on page 159

"Calculate/Compress Trace Data Query (Remote Command Only)" on page 159

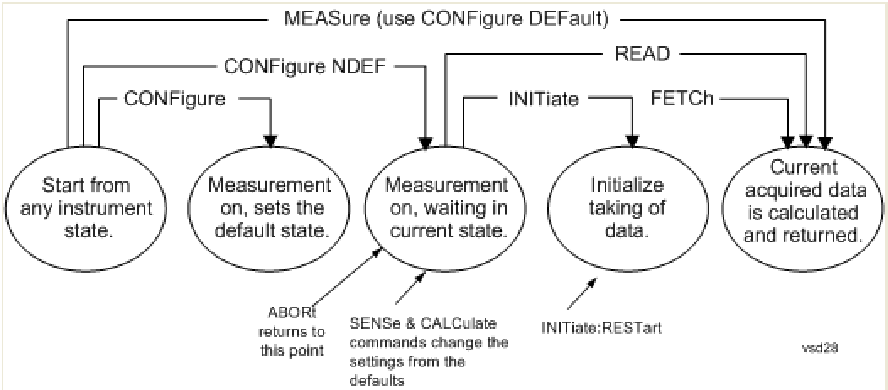
"Calculate Peaks of Trace Data (Remote Command Only)" on page 164

"Format Data: Numeric Data (Remote Command Only)" on page 166

"Format Data: Byte Order (Remote Command Only)" on page 168

Initial S/W Revision	Prior to A.02.00

Measurement Group of Commands



Measure Commands:

:MEASure:<measurement>[n]?

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Mode Setup settings (e.g. radio standard) that you have currently selected.

- Stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory defaults
- Initiates the data acquisition for the measurement
- Blocks other SCPI communication, waiting until the measurement is complete before returning results.
- If the function does averaging, it is turned on and the number of averages is set to 10.
- After the data is valid it returns the scalar results, or the trace data, for the specified measurement. The type of data returned may be defined by an [n] value that is sent with the command.

  The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available.

  ASCII is the default format for the data output. (Older versions of Spectrum Analysis and Phase Noise mode measurements only use ASCII.) The binary data formats should be used for handling large blocks of data since they are smaller and faster than the ASCII format. Refer to the FORMat:DATA command for more information.

If you need to change some of the measurement parameters from the factory default settings you can set up the measurement with the CONFigure command. Use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command to initiate the measurement and query the results.

If you need to repeatedly make a given measurement with settings other than the factory defaults, you can use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to set up the measurement. Then use the READ? command to initiate the measurement and query results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use READ:<measurement>? if you want to use those persistent settings. If you want to go back to the default settings, use MEASure:<measurement>?.

Configure Commands:

:CONFigure:<measurement>

This command stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory default instrument settings. It does not initiate the taking of measurement data unless INIT:CONTinuous is ON. If you change any measurement settings after using the CONFigure command, the READ command can be used to initiate a measurement without changing the settings back to their defaults.

In the Swept SA measurement in Spectrum Analyzer mode the CONFigure command also turns the averaging function on and sets the number of averages to 10 for all measurements.

:CONFigure:NDEFault<measurement> stops the current measurement and changes to the specified measurement. It does not change the settings to the defaults. It does not initiate the taking of measurement data unless INIT:CONTinuous is ON.

The **CONFigure?** query returns the current measurement name.

The **CONFigure:CATalog?** query returns a quoted string of all measurement names in the current mode. For example, "SAN, CHP, OBW, ACP, PST, TXP, SPUR, SEM, LIST".

Fetch Commands:

:FETCh:<measurement>[n]?

This command puts selected data from the most recent measurement into the output buffer. Use FETCh if you have already made a good measurement and you want to return several types of data (different [n] values, for example, both scalars and trace data) from a single measurement. FETCh saves you the time of re-making the measurement. You can only FETCh results from the measurement that is currently active, it will not change to a different measurement. An error is reported if a measurement other than the current one, is specified.

If you need to get new measurement data, use the READ command, which is equivalent to an INITiate followed by a FETCh.

The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster then the ASCII format. (FORMat:DATA)

FETCh may be used to return results other than those specified with the original READ or MEASure command that you sent.

INITiate Commands:

:INITiate:<measurement>
This command is not available for measurements in all the instrument modes: • Initiates a trigger cycle for the specified measurement, but does not output any data. You must then use the FETCh<meas> command to return data. If a measurement other than the current one is specified, the instrument will switch to that measurement and then initiate it. • For example, suppose you have previously initiated the ACP measurement, but now you are running the channel power measurement. If you send INIT:ACP? it will change from channel power to ACP and will initiate an ACP measurement. • Does not change any of the measurement settings. For example, if you have previously started the ACP measurement and you send INIT:ACP? it will initiate a new ACP measurement using the same instrument settings as the last time ACP was run. • If your selected measurement is currently active (in the idle state) it triggers the measurement, assuming the trigger conditions are met. Then it completes one trigger cycle. Depending upon the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events, for one full trigger cycle. It also holds off additional commands on GPIB until the acquisition is complete.
READ Commands:
:READ:<measurement>[n]? • Does not preset the measurement to the factory default settings. For example, if you have previously initiated the ACP measurement and you send READ:ACP? it will initiate a new measurement using the same instrument settings. • Initiates the measurement and puts valid data into the output buffer. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results. For example, suppose you have previously initiated the ACP measurement, but now you are running the channel power measurement. Then you send READ:ACP? It will change from channel power back to ACP and, using the previous ACP settings, will initiate the measurement and return results. • Blocks other SCPI communication, waiting until the measurement is complete before returning the results If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used when handling large blocks of data since they are smaller and faster then the ASCII format. (FORMat:DATA)

Initial S/W Revision	Prior to A.02.00

Current Measurement Query (Remote Command Only)

This command returns the name of the measurement that is currently running.

Remote Command:	`:CONFigure?`
Example:	CONF?

Initial S/W Revision:	Prior to A.02.00

Limit Test Current Results (Remote Command Only)

Queries the status of the current measurement limit testing. It returns a 0 if the measured results pass when compared with the current limits. It returns a 1 if the measured results fail any limit tests.

Remote Command:	`:CALCulate:CLIMits:FAIL?`
Example:	CALC:CLIM:FAIL? queries the current measurement to see if it fails the defined limits. Returns a 0 or 1: 0 it passes, 1 it fails.
Initial S/W Revision:	Prior to A.02.00

Data Query (Remote Command Only)

Returns the designated measurement data for the currently selected measurement and subopcode.

n = any valid subopcode for the current measurement. See the measurement command results table for your current measurement, for information about what data is returned for the subopcodes.

This command uses the data setting specified by the FORMat:BORDer and FORMat:DATA commands and can return real or ASCII data. (See the format command descriptions under Input/Output in the Analyzer Setup section.)

Remote Command:	`:CALCulate:DATA[n]?`
Notes:	The return trace depends on the measurement. In CALCulate:<meas>:DATA[n], n is any valid subopcode for the current measurement. It returns the same data as the FETCh:<measurement>? query where <measurement> is the current measurement.
Initial S/W Revision:	Prior to A.02.00

Calculate/Compress Trace Data Query (Remote Command Only)

Returns compressed data for the currently selected measurement and subopcode [n].

n = any valid sub-opcode for that measurement. See the MEASure:<measurement>? command description of your specific measurement for information on the data that can be returned.

The data is returned in the current Y Axis Unit of the analyzer. The command is used with a sub-opcode <n> (default=1) to specify the trace. With trace queries, it is best if the analyzer is not sweeping during the query. Therefore, it is generally advisable to be in Single Sweep, or Update=Off.

This command is used to compress or decimate a long trace to extract and return only the desired data. A typical example would be to acquire N frames of GSM data and return the mean power of the first burst in each frame. The command can also be used to identify the best curve fit for the data.

Remote Command:	`:CALCulate:DATA<n>:COMPress? BLOCk|CFIT|MAXimum|MINimum|MEAN|DMEan|RMS|RMSCubed|SAMPle|SDEViation|PPHase [,<soffset>[,<length>[,<roffset>[,<rlimit>]]]]`
Notes:	The command supports 5 parameters. Note that the last 4 (<soffset>,<length>,<roffset>,<rlimit>) are optional. But these optional parameters must be entered in the specified order. For example, if you want to specify <length>, then you must also specify <soffset>. See details below for a definition of each of these parameters. This command uses the data in the format specified by FORMat:DATA, returning either binary or ASCII data.
Example:	To query the mean power of a set of GSM bursts: Supply a signal that is a set of GSM bursts. Select the IQ Waveform measurement (in IQ Analyzer Mode). Set the sweep time to acquire at least one burst. Set the triggers such that acquisition happens at a known position relative to a burst. Then query the mean burst levels using, CALC:DATA2:COMP? MEAN,24e–6,526e–6 (These parameter values correspond to GSM signals, where 526e–6 is the length of the burst in the slot and you just want 1 burst.)
Initial S/W Revision:	Prior to A.02.00

- BLOCk or block data - returns all the data points from the region of the trace data that you specify. For example, it could be used to return the data points of an input signal over several timeslots, excluding the portions of the trace data that you do not want. (This is x,y pairs for trace data and I,Q pairs for complex data.)
- CFIT or curve fit - applies curve fitting routines to the data. <soffset> and <length> are required to define the data that you want. <roffset> is an optional parameter for the desired order of the curve equation. The query will return the following values: the x-offset (in seconds) and the curve coefficients ((order + 1) values).

MIN, MAX, MEAN, DME, RMS, RMSC, SAMP, SDEV and PPH return one data value for each specified region (or <length>) of trace data, for as many regions as possible until you run out of trace data (using <roffset> to specify regions). Or they return the number of regions you specify (using <rlimit>) ignoring any data beyond that.

- MINimum - returns the minimum data point (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.
- MAXimum - returns the maximum data point (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the maximum magnitude of the I/Q pairs is returned.

NOTE

MEAN - returns a single value that is the arithmetic mean of the data point values (in dB/ dBm) for the specified region(s) of trace data. For I/Q trace data, the mean of the magnitudes of the I/Q pairs is returned. See the following equations.

If the original trace data is in dB, this function returns the arithmetic mean of those log values, not log of the mean power which is a more useful value. The mean of the log is the better measurement technique when measuring CW signals in the presence of noise. The mean of the power, expressed in dB, is useful in power measurements such as Channel Power. To achieve the mean of the power, use the RMS option.

Equation 1
Mean Value of Data Points for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} Xi$$

vsd27-1

where Xi is a data point value, and n is the number of data points in the specified region(s).

Equation 2
Mean Value of I/Q Data Pairs for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} |Xi|$$

vsd27-2

where |Xi| is the magnitude of an I/Q pair, and n is the number of I/Q pairs in the specified region(s).

- DMEan - returns a single value that is the mean power (in dB/ dBm) of the data point values for the specified region(s) of trace data. See the following equation:

Equation 3
DMEan Value of Data Points for Specified Region(s)

$$\text{DME} = 10 \times \log_{10}\left(\frac{1}{n} \sum_{Xi \in \text{region(s)}} 10^{\frac{Xi}{10}}\right)$$

vsd27-3

- RMS - returns a single value that is the average power on a root-mean-squared voltage scale (arithmetic rms) of the data point values for the specified region(s) of trace data. See the following equation.

NOTE

For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. See the following equation.

This function is very useful for I/Q trace data. However, if the original trace data is in dB, this function returns the rms of the log values which is not usually needed.

Equation 4
RMS Value of Data Points for Specified Region(s)

$$RMS = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} Xi^2}$$

vsd27-4

where Xi is a data point value, and n is the number of data points in the specified region(s).

Equation 5
RMS Value of I/Q Data Pairs for Specified Region(s)

$$RMS = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} Xi\ Xi^*}$$

vsd27-5

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region(s).

Once you have the rms value for a region of trace data (linear or I/Q), you may want to calculate the mean power. You must convert this rms value (peak volts) to power in dBm:

10 x log[10 x (rms value)2]

- SAMPle - returns the first data value (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.
- SDEViation - returns a single value that is the arithmetic standard deviation for the data point values for the specified region(s) of trace data. See the following equation.

  For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned. See the following equation.

Equation 6
Standard Deviation of Data Point Values for Specified Region(s)

$$SDEV = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} (Xi - \overline{X})^2}$$

vsd27-7

where Xi is a data point value, X is the arithmetic mean of the data point values for the specified region(s), and n is the number of data points in the specified region(s).

$$SDEV = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} (|Xi| - \overline{X})^2}$$

vsd27-8

where |Xi| is the magnitude of an I/Q pair, X is the mean of the magnitudes for the specified region(s), and n is the number of data points in the specified region(s).

- PPHase - returns the x,y pairs of both rms power (dBm) and arithmetic mean phase (radian) for every specified region and frequency offset (Hz). The number of pairs is defined by the specified number of regions. This parameter can be used for I/Q vector (n=0) in Waveform (time domain) measurement and all parameters are specified by data point in PPHase.

  The rms power of the specified region may be expressed as:

  Power = 10 x log [10 x (RMS I/Q value)] + 10.

The RMS I/Q value (peak volts) is:

$$\sqrt{\frac{1}{n}\sum_{Xi \in \text{ region}} Xi\ Xi^*}$$

vsd27-9

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region.

The arithmetic mean phase of the specified region may be expressed as:

$$\frac{1}{n}\sum_{Yi \in \text{ region}} Yi$$

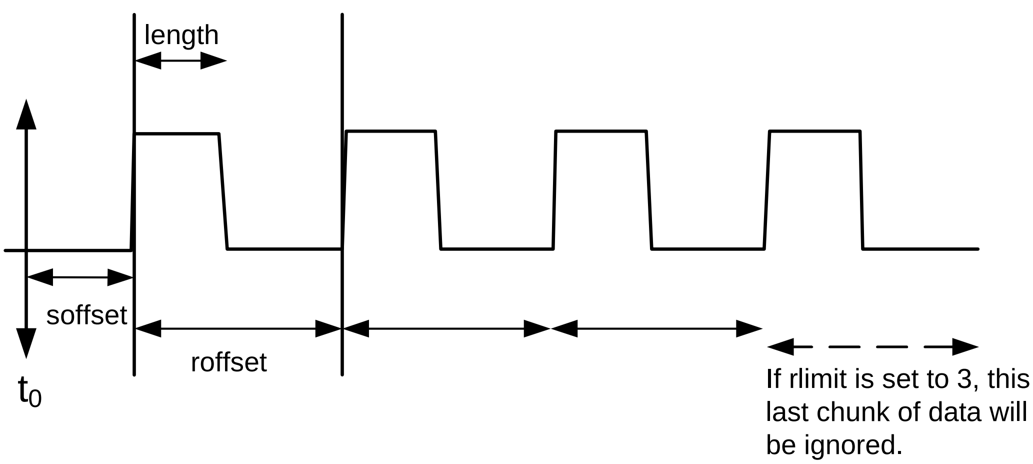
vsd27-10

where Yi is the unwrapped phase of I/Q pair with applying frequency correction and n is the number of I/Q pairs in the specified region.

The frequency correction is made by the frequency offset calculated by the arithmetic mean of every specified region's frequency offset. Each frequency offset is calculated by the least square method against the unwrapped phase of I/Q pair.

Sample Trace Data - Constant Envelope

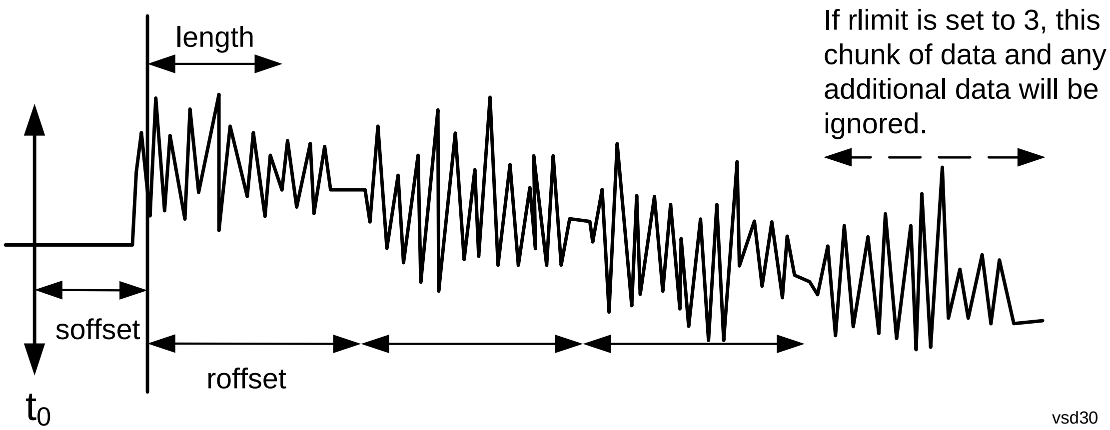
(See below for explanation of variables.)



vsd29

Sample Trace Data - Not Constant Envelope

(See below for explanation of variables.)



<soffset> - start offset is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces). It specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time or frequency change from the start of the trace to the point where you want to start using the data. The default value is zero.

<length> - is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces). It defines how much data will be compressed into one value. This parameter has a default value equal to the current trace length.

<roffset> - repeat offset is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces). It defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field. This parameter has a default value equal to the <length> variable. Note that this parameter is used for a completely different purpose when curve fitting (see CFIT above).

<rlimit> - repeat limit is an optional integer. It specifies the number of data items that you want returned. It will ignore any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use. The default value is all the data.

Calculate Peaks of Trace Data (Remote Command Only)

Returns a list of all the peaks for the currently selected measurement and sub-opcode [n]. The peaks must meet the requirements of the peak threshold and excursion values.

n = any valid sub-opcode for the current measurement. See the MEASure:<measurement> command description of your specific measurement for information on the data that can be returned.

The command can only be used with specific sub-opcodes with measurement results that are trace data. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. In many measurements the sub-opcode n=0, is the raw trace data which cannot be searched for peaks. And Sub-opcode n=1, is often calculated results values which also cannot be searched for peaks.

This command uses the data setting specified by the FORMat:BORDer and FORMat:DATA commands and can return real or ASCII data. If the format is set to INT,32, it returns REAL,32 data.

The command has four types of parameters:

- Threshold (in dBm)
- Excursion (in dB)
- Sorting order (amplitude, frequency, time)
- Optional in some measurements: Display line use (all, > display line, < display line)

Remote Command:	For Swept SA measurement:
	`:CALCulate:DATA[1]|2|3|4|5|6:PEAKs? <threshold>,<excursion>[,AMPLitude|FREQuency|TIME[,ALL|GTDLine|LTDLine]]`
	For most other measurements:
	`:CALCulate:DATA[1]|2|3|4|5|6:PEAKs? <threshold>,<excursion>[,AMPLitude|FREQuency|TIME]`

Example:	Example for Swept SA measurement in Spectrum Analyzer Mode: CALC:DATA4:PEAK? –40,10,FREQ,GTDL This will identify the peaks of trace 4 that are above –40 dBm, with excursions of at least 10 dB. The peaks are returned in order of increasing frequency, starting with the lowest frequency. Only the peaks that are above the display line are returned. Query Results 1: With FORMat:DATA REAL,32 selected, it returns a list of floating-point numbers. The first value in the list is the number of peak points that are in the following list. A peak point consists of two values: a peak amplitude followed by its corresponding frequency (or time). If no peaks are found the peak list will consist of only the number of peaks, (0).

Notes:	<n> - is the trace that will be used <threshold> - is the level below which trace data peaks are ignored. Note that the threshold value is required and is always used as a peak criterion. To effectively disable the threshold criterion for this command, provide a substantially low threshold value such as –200 dBm. Also note that the threshold value used in this command is independent of and has no effect on the threshold value stored under the Peak Criteria menu. <excursion> - is the minimum amplitude variation (rise and fall) required for a signal to be identified as peak. Note that the excursion value is required and is always used as a peak criterion. To effectively disable the excursion criterion for this command, provide the minimum value of 0.0 dB. Also note that the excursion value used in this command is independent of and has no effect on the excursion value stored under the Peak Criteria menu. Values must be provided for threshold and excursion. The sorting and display line parameters are optional (defaults are AMPLitude and ALL). Note that there is always a Y-axis value for the display line, regardless of whether the display line state is on or off. It is the current Y-axis value of the display line which is used by this command to determine whether a peak should be reportedSorting order: AMPLitude - lists the peaks in order of descending amplitude, with the highest peak first (default if optional parameter not sent) FREQuency - lists the peaks in order of occurrence, left to right across the x-axis. TIME - lists the peaks in order of occurrence, left to right across the x-axis. Peaks vs. Display Line: ALL - lists all of the peaks found (default if optional parameter not sent). GTDLine (greater than display line) - lists all of the peaks found above the display line. LTDLine (less than display line) - lists all of the peaks found below the display line.
Initial S/W Revision:	Prior to A.02.00

Format Data: Numeric Data (Remote Command Only)

This command specifies the format of the trace data input and output. It specifies the formats used for trace data during data transfer across any remote port. It affects only the data format for setting and querying trace data for the :TRACe[:DATA], TRACe[:DATA]?, :CALCulate:DATA[n]? and FETCh:SANalyzer[n]? commands and queries.

Remote Command:	`:FORMat[:TRACe][:DATA] ASCii|INTeger,32|REAL,32 |REAL,64`
	
	`:FORMat[:TRACe][:DATA]?`

Notes:	The query response is: ASCii: ASC,8 REAL,32: REAL,32 REAL,64: REAL,64 INTeger,32: INT,32 When the numeric data format is REAL or ASCii, data is output in the current Y Axis unit. When the data format is INTeger, data is output in units of m dBm (.001 dBm). Note that the INT,32 format is only applicable to the command, TRACe:DATA. This preserves backwards compatibility for the Swept SA measurement. For all other commands/queries which honor FORMat:DATA, if INT,32 is sent the analyzer will behave as though it were set to REAL,32. The INT,32 format returns binary 32-bit integer values in internal units (m dBm), in a definite length block.
Dependencies:	Sending a data format spec with an invalid number (for example, INT,48) generates no error. The analyzer simply uses the default (8 for ASCii, 32 for INTeger, 32 for REAL). Sending data to the analyzer which does not conform to the current FORMat specified, results in an error.
Preset:	ASCii
Initial S/W Revision:	Prior to A.02.00

The specs for each output type follow:

ASCii - Amplitude values are in ASCII, in the current Y Axis Unit, one ASCII character per digit, values separated by commas, each value in the form:

SX.YYYYYEsZZ

Where:

S = sign (+ or -)

X = one digit to left of decimal point

Y = 5 digits to right of decimal point

E = E, exponent header

s = sign of exponent (+ or -)

ZZ = two digit exponent

REAL,32 - Binary 32-bit real values in the current Y Axis Unit, in a definite length block.

REAL,64 - Binary 64-bit real values in the current Y Axis Unit, in a definite length block.

Format Data: Byte Order (Remote Command Only)

This command selects the binary data byte order for data transfer and other queries. It controls whether binary data is transferred in normal or swapped mode. This command affects only the byte order for setting and querying trace data for the :TRACe[:DATA], TRACe[:DATA]? , :CALCulate:DATA[n]? and FETCh:SANalyzer[n]? commands and queries.

By definition any command that says it uses FORMat:DATA uses any format supported by FORMat:DATA.

The NORMal order is a byte sequence that begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last in the sequence: 1|2|3|4. SWAPped order is when the byte sequence begins with the LSB first, and ends with the MSB last in the sequence: 4|3|2|1.

Remote Command:	`:FORMat:BORDer NORMal|SWAPped` `:FORMat:BORDer?`
Preset:	NORMal
Initial S/W Revision:	Prior to A.02.00

Meas Setup

The Meas Setup key opens up a menu of softkeys that allow you to control the most important parameters for the current measurement.

NOTE In the Meas Setup menu you may configure Averaging, by setting the Average Number and the Average Type.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Average/Hold Number

Sets the terminal count number N for **Average, Max Hold** and **Min Hold** trace types. This number is an integral part of how the average trace is calculated. Basically, increasing N results in a smoother average trace.

See “More Information” on page 169.

See “AVER:CLE command” on page 169.

Key Path	**Meas Setup**
Remote Command	`[:SENSe]:AVERage:COUNt <integer>` `[:SENSe]:AVERage:COUNt?`

Couplings	Restarting any of these functions (**Average, Max Hold** or **Min Hold)** restarts all of them, as there is only one count.
Preset	100
State Saved	Saved in Instrument State
Min	1
Max	10000
Status Bits/OPC dependencies	See the Section “Sweep/Control” on page 263 for a discussion of the Sweeping, Measuring, Settling and OPC bits, and the Hi Sweep line. All are affected when a sequence is reset.
Initial S/W Revision	Prior to A.02.00

More Information

When in **Single**, the sweep stops when N is reached. If you want to add one more Average, or one more trace to Max Hold or Min Hold, simply press the Up key while Average/Hold Number is the active function.

In **Cont** (continuous), averaging and holding continues even after N is reached. Therefore, using doing trace holding in **Cont**, the value of N is irrelevant. But for averaging, each new sweep is exponentially averaged in with a weighting equal to N.

For details of how the average trace is calculated and how this depends on the **Average/Hold Number**, see “Average Type” on page 170. For details on how the various control functions in the instrument start and restart averaging. See the Section “Sweep/Control” on page 263for a discussion of the Sweeping, Measuring, Settling and OPC bits, and the Hi Sweep line. All are affected when a sequence is reset.

The Average/Hold Number is not affected by Auto Couple.

AVER:CLE command

The AVER:CLE command (below) resets the average/hold count and does an INIT:IMM, which begins another set of sweeps when trigger conditions are satisfied. It only does this if an active trace is in Average or Hold type.

Remote Command:	`[:SENSe]:AVERage:CLEar`
Example:	AVER:COUN 100 AVER:CLE sets the current count (k and K) to 1 and restarts the averaging process.
Notes:	When the instrument receives this command it performs an INIT:IMM, if and only if there is an active trace in Max Hold, Min Hold, or Average type.
Default Unit:	Enter
Initial S/W Revision:	Prior to A.02.00

Average Type

Lets you control the way averaging is done by choosing one of the following averaging scales: log-power (video), power (RMS), or voltage averaging. Also lets you choose Auto Average Type (default).

When performing Trace Averaging, , the equation that is used to calculate the averaged trace depends on the average type. See the descriptions for the keys which select each Average Type ("Log-Pwr Avg (Video)" on page 171(Video), "Pwr Avg (RMS)" on page 172(RMS), or "Voltage Avg" on page 172) for details on these equations.

See "More Information" on page 170.

Key Path	**Meas Setup**
Remote Command	`[:SENSe]:AVERage:TYPE:AUTO OFF|ON|0|1` `[:SENSe]:AVERage:TYPE:AUTO?`
Preset	ON
State Saved	Saved in Instrument State
Readback line	1-of-N selection as Log-Pwr (Video) for Log-Pwr (Video) Avg Pwr (RMS) for Power Avg Voltagefor Voltage
Initial S/W Revision	Prior to A.02.00

Remote Command:	`[:SENSe]:AVERage:TYPE RMS|LOG|SCALar` `[:SENSe]:AVERage:TYPE?`
Notes:	Parameters map to avg types as: RMS = Pwr (RMS) Avg LOG = Log-Pwr (Video) Avg SCALar = Voltage Avg
Preset:	LOG
Backwards Compatibility SCPI:	[:SENSe]:AVERage:TYPE LINear sets Scalar averaging [:SENSe]:AVERage:TYPE VOLTage sets Scalar averaging [:SENSe]:AVERage:TYPE VIDeo sets Log-Power averaging [:SENSe]:AVERage:TYPE LPOWer sets Log-Power averaging [:SENSe]:AVERage:TYPE POWer sets RMS averaging
Initial S/W Revision:	Prior to A.02.00

More Information

When you select log-power averaging, the measurement results are the average of the signal level in logarithmic units (decibels). When you select power average (RMS), all measured results are converted into power units before averaging and filtering operations, and converted back to decibels for displaying. Remember: there can be significant differences between the average of the log of power and the log of the average power.

These are the averaging processes within a spectrum analyzer and all of them are affected by this setting:

Trace averaging (see Section "Trace/Detector" on page 428") averages signal amplitudes on a trace-to-trace basis. The average type applies to all traces in Trace Average (it is not set on a trace-by-trace basis).

Average detector (see Section "Trace/Detector" on page 428") averages signal amplitudes during the time or frequency interval represented by a particular measurement point.

Noise Marker (see Section "Marker Function" on page 1593") averages signal amplitudes across measurement points to reduce variations for noisy signals.

VBW filtering (see Section "BW" on page 1473") adds video filtering which is a form of averaging of the video signal.

When **Auto** is selected, the analyzer chooses the type of averaging (see below). When one of the average types is selected manually, the analyzer uses that type regardless of other analyzer settings, and shows Man on the **Average Type** softkey.

Auto

Chooses the optimum type of averaging for the current instrument measurement settings.

Key Path	**Meas setup, Average Type**
Example	AVER:TYPE:AUTO ON
Notes	See **Average Type**, above
Couplings	Here are the auto-select rules for **Average Type:** **Auto** selects **Voltage Averaging** if the Detector for any active trace is **EMI Average** or **QPD or RMS Average**; otherwise it selects **Power (RMS)** Averaging if a **Marker Function** (**Marker Noise**, **Band/Intvl Power**) is on, or **Detector** is set to **Man** and **Average**; otherwise if **Amplitude**, **Scale Type** is set to **Lin** it selects **Voltage** Averaging; otherwise, if the EMC Standard is set to CISPR, it selects Voltage; otherwise **Auto** selects **Log-Power** Average. Note that these rules are only applied to active traces. Traces which are not updating do not impact the auto-selection of Average Type.
State Saved	Saved in Instrument State
Readback	The type auto-selected is displayed in the readback line on the **Average Type** key
Initial S/W Revision	Prior to A.02.00

Log-Pwr Avg (Video)

Selects the logarithmic (decibel) scale for all filtering and averaging processes. This scale is sometimes called "Video" because it is the most common display and analysis scale for the video signal within a spectrum analyzer. This scale is excellent for finding CW signals near noise, but its response to noise-like signals is 2.506 dB lower than the average power of those noise signals. This is compensated for in the Marker Noise function.

The equation for trace averaging on the log-pwr scale is shown below, where K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value, providing a continuous running average.)

New avg = ((K–1)Old avg + New data)/K

Assumes all values in decibel scale.

Key Path	**Meas setup, Average Type**
Example	AVER:TYPE LOG
Notes	See ""Average Type" on page 170"
Couplings	See ""Auto" on page 171"
Readback	**Log-Pwr (Video)**
Initial S/W Revision	Prior to A.02.00

Pwr Avg (RMS)

In this average type, all filtering and averaging processes work on the power (the square of the magnitude) of the signal, instead of its log or envelope voltage. This scale is best for measuring the true time average power of complex signals. This scale is sometimes called RMS because the resulting voltage is proportional to the square root of the mean of the square of the voltage.

In the equation for averaging on this scale (below), K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value, providing a running average.)

New avg = 10 log ((1/K)((K–1)(10Old avg/10)+10New data/10))

Equation assumes all values are in the decibel scale.

Key Path	**Meas setup, Average Type**
Example	AVER:TYPE RMS
Notes	See "Average Type" on page 170
Couplings	See "Auto" on page 171
Readback	**Pwr (RMS)**
Initial S/W Revision	Prior to A.02.00

Voltage Avg

In this Average type, all filtering and averaging processes work on the voltage of the envelope of the signal. This scale is good for observing rise and fall behavior of AM or pulse-modulated signals such as radar and TDMA transmitters, but its response to noise-like signals is 1.049 dB lower than the average power of those noise signals. This is compensated for in the **Marker Noise** function.

In the equation for averaging on this scale (below), K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value.)

New avg = 20 log ((1/K)((K–1)(10Old avg/20)+10New data/20))

Equation assumes all values are in the decibel scale.

Key Path	**Meas setup, Average Type**
Example	AVER:TYPE SCAL
Notes	See “Average Type” on page 170
Couplings	See “Auto” on page 171
Readback	**Pwr (RMS)**
Initial S/W Revision	Prior to A.02.00

Limits

The limits softkey opens up a menu of softkeys to control the limits for the current measurement. Limits arrays can be entered by the user, sent over SCPI, or loaded from a file.

Initial S/W Revision	A.02.00
Key Path	**Meas Setup**
Dependencies	This key will only appear if you have the proper option installed in your instrument.
Preset	Limits are turned off by a Preset, but the Limits arrays (data) are only reset (deleted) by Restore Mode Defaults. They survive shutdown and restarting of the analyzer application, which means they will survive a power cycle.

Select Limit

Specifies the selected limit. The term “selected limit” is used throughout this document to specify which limit will be affected by the functions.

Key Path	**Meas Setup, Limits**
Notes	The selected limit is remembered even when not in the Limit Menu.
Preset	Limit 1, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in State.
Initial S/W Revision	A.02.00

Limit On/Off

Selects whether the limit and margin are displayed. If Test Limits is on, this also determines whether the test trace (see “Test Trace” on page 175) will be tested against the limit. If **Limit On/Off** is **On**, the following occurs:

- The limit line is displayed, in the same color as the limited trace, but paler. Portions of traces which fail the limits will be displayed in red.
- The margin line is displayed if Margin is on and the Margin Value is non-zero (see “Margin” on page 180). The margin line is displayed in the same color as the limit line, but paler still and dashed. Portions of traces which pass the limits but fail the margin will be displayed in amber.
- The trace is tested for the purpose of the “Trace Pass/Fail”indication in the graticule if, in addition to **Limit On/Off** being **On,** the trace is displayed and **Test Limits (All Limits)** is on (see “Test Limits” on page 186). If the trace is not tested, no report of the trace passing or failing is seen on the graticule. Note that the SCPI queries of Limit Pass/Fail are independent of these conditions; the test is always performed when queried over SCPI.

The PASS/FAIL box in the corner of the Meas Bar is only displayed if there is at least one “Trace Pass/Fail” indication displayed in the graticule.

Note that the red and amber coloring of traces which fail the limits and/or margins only applies to traces whose X-axis corresponds to the current analyzer X-axis. Traces which are not updating (in View, for example) will not change color if the analyzer X-axis settings (eg, start and stop frequency) do not match those of the trace, for example if they have been changed since the trace stopped updating. In this case, the Invalid Data indicator (*) will appear in the upper right hand corner.

When the limits are frequency limits but the trace is a zero-span trace, the limit trace is drawn at the limit amplitude of the center frequency. When the limits are time limits but the trace is a frequency domain trace, the limit trace is drawn according to the current time axis, with the left of the screen being 0 and the right being equal to sweep time.

Key Path	**Meas Setup, Limits**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:DISPlay OFF|ON|0|1` `:CALCulate:LLINe[1]|2|3|4|5|6:DISPlay?`
Example	:CALC:LLIN2:DISP ON !turns on the display for limit line 2.
Dependencies	This command will generate an “Option not available” error unless you have the proper option installed in your instrument.
Couplings	Limit display ON selects the limit. Testing is done on all displayed limits if **Test Limits (All Limits)** is ON. Entering the limit menu from the GUI turns on the selected limit.
Preset	OFF
State Saved	Saved in State.
Backwards Compatibility SCPI	:CALCulate:LLINe[1]|2:STATe OFF|ON|0|1 (In the past you had to send the DISP command as well as the STATe command in order to get a limit on and testing. Now, the DISP command is sufficient, but we accept the state command and do nothing with it)
Initial S/W Revision	A.02.00

Properties

Accesses a menu which lets you set the properties of the selected limit.

Key Path	**Meas Setup, Limits**
Initial S/W Revision	A.02.00

Select Limit

Specifies the selected limit. The term “selected limit” is used throughout this document to specify which limit will be affected by the functions.

Key Path	**Meas Setup, Limits, Properties**
Notes	The selected limit is remembered even when not in the Limit Menu.
Preset	Limit 1, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in State.
Initial S/W Revision	A.02.00

Test Trace

Selects the trace you want the limit to test. A limit is applied to one and only one trace; each trace can have both an upper and a lower limit. When executing Limit Test, the limit is applied only to the specified trace.

A trace can have multiple limit lines simultaneously; in that case, only one upper and one lower limit line will affect the color of the trace. Other limit lines will be displayed, and will affect the pass/fail status, but the trace will not turn red if it crosses a secondary limit line.

Key Path	**Meas Setup, Limits, Properties**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:TRACe 1|2|3|4|5|6` `:CALCulate:LLINe[1]|2|3|4|5|6:TRACe?`
Example	:CALC:LLIN3:TRAC 2 applies limit 3 to trace 2.
Notes	When the trace display is off, the trace is not tested. The trace is tested only when the trace display is on and Test Limits (see “Test Limits” on page 186) is on.
Couplings	This matters when testing a trace or limit line for failure, via :CALC:LLIN3:FAIL? or :CALC:TRAC2:FAIL?
Preset	Limits 1 and 2 preset to 1, Limits 3 and 4 preset to 2, Limits 5 and 6 preset to 3 Not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in State.
Min	1
Max	6
Readback	Trace 1|2|3|4|5|6

Initial S/W Revision	A.02.00

Type

Selects whether the limit you are editing is an upper or lower limit. An upper limit fails if the trace exceeds the limit. A lower limit fails if the trace falls below the limit.

Key Path	**Meas Setup, Limits, Properties**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:TYPE UPPer|LOWer` `:CALCulate:LLINe[1]|2|3|4|5|6:TYPE?`
Example	:CALC:LLIN2:TYPE LOW !sets limit line 2 to act as a lower limit.
Couplings	If a margin has already been set for this limit line, and this key is used to change the limit type, then the margin value will reverse sign.
Preset	Upper for Line 1, 3, and 5; Lower for Line 2, 4, 6. Not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in State.
Initial S/W Revision	A.02.00

Interpolation

Accesses a menu which lets you set the frequency and amplitude interpolation of the selected limit.

Key Path	**Meas Setup, Limits, Properties**
Readback	[Lin|Log Frequency, Lin|Log Amplitude]
Initial S/W Revision	A.02.00

Frequency Interpolation

This key is grayed out if Time is the selected X Axis Units. Sets the interpolation between frequency points, allowing you to determine how limit trace values are computed between points in a limit table. The available interpolation modes are linear and logarithmic. If frequency interpolation is logarithmic (Log), frequency values between limit points are computed by first taking the logarithm of both the table values and the intermediate value. A linear interpolation is then performed in this logarithmic frequency space. An exactly analogous manipulation is done for logarithmic amplitude interpolation.

Note that the native representation of amplitude is in dB.

For linear amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$y = 20\log\left(\frac{10^{\frac{y_{i+1}}{20}} - 10^{\frac{y_i}{20}}}{f_{i+1} - f_i}(f - f_i) + 10^{\frac{y_i}{20}}\right)$$

For linear amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$y = 20\log\left(\frac{10^{\frac{y_{i+1}}{20}} - 10^{\frac{y_i}{20}}}{\log f_{i+1} - \log f_i}(\log f - \log f_i) + 10^{\frac{y_i}{20}}\right)$$

For log amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{f_{i+1} - f_i}(f - f_i) + y_i$$

For log amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{\log f_{i+1} - \log f_i}(\log f - \log f_i) + y_i$$

NOTE Interpolation modes determine how limit values are computed between points in the limit table. The appearance of a limit trace is also affected by the amplitude scale, which may be linear or logarithmic.

Key Path	**Meas Setup, Limits, Properties, Interpolation**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:CONTrol:INTerpolate:TYPE LOGarithmic|LINear` `:CALCulate:LLINe[1]|2|3|4|5|6:CONTrol:INTerpolate:TYPE?`
Example	:CALC:LLIN:CONT:INT:TYPE LIN !sets limit line 1 frequency interpolation to linear.
Preset	Linear, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

Amplitude Interpolation

Sets the interpolation to linear or logarithmic for the specified limiting points set, allowing you to determine how limit trace values are computed between points in a limit table. See Frequency Interpolation for the equations used to calculate limit values between points.

Key Path	**Meas Setup, Limits, Properties, Interpolation**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:AMPLitude:INTerpolate:TYPE LOGarithmic|LINear` `:CALCulate:LLINe[1]|2|3|4|5|6:AMPLitude:INTerpolate:TYPE?`
Example	:CALC:LLIN:AMPL:INT:TYPE LIN !sets limit line 1 amplitude interpolation to linear.
Preset	Logarithmic, not affected by Mode Preset, preset by Restore Mode Defaults.

State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

Fixed / Relative

Opens a menu which will allow you to specify that the selected limit is relative to either Center Frequency or Reference level.

Key Path	**Meas Setup, Limits, Properties**
Readback	Fixed|Rel to CF|Rel to RL|Rel to CF + RL (square brackets)
Initial S/W Revision	A.02.00

Relative to CF

Chooses whether the limit line frequency points are coupled to the instrument center frequency, and whether the frequency points are expressed as an offset from the instrument center frequency. If the limit lines are specified with time, this has no effect. The limit table must in this case support negative frequencies.

For example, assume you have a frequency limit line, and the analyzer center frequency is at 1 GHz. If Relative to CF is “Off”, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at 300 MHz, and the limit line segment will not change frequency if the center frequency changes. If Relative to CF is “On”, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at CF + 300 MHz, or 1.3 GHz. Furthermore, if the center frequency changes to 2 GHz, the limit line segment will be displayed at CF + 300 MHz, or 2.3 GHz.

It is possible to change this setting after a limit line has been entered. When changing from On to Off or vice-versa, the frequency values in the limit line table change so that the limit line remains in the same position for the current frequency settings of the analyzer.

Pressing this button makes Center Frequency the active function.

Key Path	**Meas Setup, Limits, Properties, Fixed/Relative**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:FREQuency:CMODe:RELative ON|OFF|1|0` `:CALCulate:LLINe[1]|2|3|4|5|6:FREQuency:CMODe:RELative?`
Example	:CALC:LLIN:FREQ:CMOD:REL ON !makes limit line 1 relative to the center frequency.
Notes	If the Trace Domain is changed to Time (:CALCulate:LLINe:CONTrol:DOMain TIME), the SCPI command : :CALCulate:LLINe[1]|2|3|4|5|6:FREQuency:CMODe:RELative ON|OFF|1|0 will have no effect.
Couplings	Pressing this button makes Center Frequency the active function.
Preset	Off, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

Relative to RL

Chooses whether the limit line amplitude points are coupled to the instrument reference level, and whether the amplitude points are expressed as an offset from the instrument reference level.

For example, assume you have a limit line, and the reference level at –10 dBm. If Relative to RL is “Off”, entering a limit line segment with an amplitude coordinate of –20 dB displays the limit line segment at –20 dBm, and the limit line segment will not change amplitude if the reference level amplitude changes. If Relative to RL is “On”, entering a limit line segment with an amplitude coordinate of –20 dB displays the limit line segment at RL – 20 dB, or –30 dBm. Furthermore, if the reference level amplitude changes to –30 dBm, the limit line segment will be displayed at RL – 20 dB, or –50 dBm.

It is possible to change this setting after a limit line has been entered. When changing from On to Off or vice-versa, the amplitude values in the limit line table change so that the limit line remains in the same position for the current reference level settings of the analyzer.

Key Path	**Meas Setup, Limits, Properties, Fixed/Relative**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:AMPLitude:CMODe:RELative ON|OFF|1|0` `:CALCulate:LLINe[1]|2|3|4|5|6:AMPLitude:CMODe:RELative?`
Example	:CALC:LLIN:AMPL:CMOD:REL ON !makes limit line 1 relative to the reference level amplitude.
Couplings	Pressing this button makes Reference level the active function.
Preset	Off, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

Description

Provides a description of up to 60 characters by which the operator can easily identify the limit. Will be stored in the exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen dump.

Key Path	**Meas Setup, Limits, Properties**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:DESCription "Description"` `:CALCulate:LLINe[1]|2|3|4|5|6:DESCription?`
Example	:CALC:LLIN:DESC “European Emissions”
Preset	“” (null String), not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument stat.e
Readback	As much of the description will fit on one line of the key, followed by “…” if some of the description will not fit on one line of the key.
Initial S/W Revision	A.02.00

Comment

Sets an ASCII comment field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen dump. The Limits .csv file supports this field.

Key Path	**Meas Setup, Limits, Properties**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:COMMent "text"` `:CALCulate:LLINe[1]|2|3|4|5|6:COMMent?`
Example	:CALC:LLIN1:COMM "this is a comment"
Preset	“” (null String), not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Readback	As much of the description will fit on one line of the key, followed by “…” if some of the description will not fit on one line of the key.
Initial S/W Revision	A.02.00

Margin

Selects a margin for this limit, which will cause a trace to Fail Margin when the trace is between the limit line and the margin line.   Portions of the traces which pass the limit but fail the margin will be displayed in an amber color.

A margin is always specified in dB relative to a limit – an upper limit will always have a negative margin, and a lower limit will always have a positive margin. If a value is entered with the incorrect sign, the system will automatically take the negative of the entered value.

If the limit type is switched from lower to upper while margin is present, the margin will reverse sign.

When the Margin is selected, it may be turned off by pressing the Margin key until Off is underlined. This may also be done by performing a preset. Margin is the default active function whenever the margin is on, and it is not the active function whenever the margin is off.

The margin lines are displayed in the same color as limit lines, but paler. . If the limited trace is blanked then the limit line and the margin line will be blanked as well.

Key Path	**Meas Setup, Limits**

Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:MARGin <rel_ampl>`
	`:CALCulate:LLINe[1]|2|3|4|5|6:MARGin?`
	`:CALCulate:LLINe[1]|2|3|4|5|6:MARGin:STATe OFF|ON|0|1`
	`:CALCulate:LLINe[1]|2|3|4|5|6:MARGin:STATe?`

Example	:CALC:LLIN1:MARG –2dB !sets limit line 1’s margin to –2 dB (Limit Line 1 is by default an upper limit). :CALC:LLIN2:MARG 1dB !sets limit line 2’s margin to 1 dB (Limit Line 2 is by default a lower limit). :CALC:LLIN2:MARG:STAT OFF !turns off the margin for limit line 2 and removes any tests associated with that margin line.
Notes	The queries “Limit Line Fail?” (:CALCulate:LLINe[1]|2|3|4|5|6:FAIL?) and “Trace Fail?” (:CALCulate:TRACe[1]|2|3|4|5|6:FAIL?) will return 1 if the margin fails.
Couplings	This will affect :CALC:LLIN3:FAIL or :CALC:TRAC2:FAIL?
Preset	not affected by Mode Preset, set to 0 dB for all Limits by Restore Mode Defaults.
State Saved	Saved in instrument state.
Min	–40 dB (Upper); 0 dB (Lower)
Max	0 dB (Upper); 40 dB (Lower);
Default Unit	dB
Initial S/W Revision	A.02.00

Edit

Opens the Table Editor for the selected limit line.

When entering the menu, the editor window (with the limit table) turns on, the selected Limit is turned **On** and the amplitude scale is set to **Log.** The display of the trace to which the selected limit applies is turned on (thus, traces in Blank are set to View and traces in Background are set to On). Turning on the Limit means it’s display will be on, and it’s testing mode will be on as well; you should turn off any other limits that are on if they interfere with the editing of the selected limit.

NOTE The table editor will only operate properly if the analyzer is sweeping, because its updates are tied to the sweep system. Thus, you should not try to use the editor in single sweep, and it will be sluggish during compute-intensive operations like narrow-span FFT sweeps.

When exiting the edit menu (by using the Return key or by pressing an instrument front panel key), the editor window turns off, however the Limit is still on and displayed, and the amplitude scale remains **Log**.

Limits are turned off by a Preset, but the Limits arrays (data) are only reset (deleted) by Restore Mode Defaults. They survive shutdown and restarting of the analyzer application, which means they will survive a power cycle.

Key Path	**Meas Setup, Limits**

Couplings	Turns the Limit Peaks table off. A remote user can enter or access limit line data via :CALCulate:LLINe[1]|2|3|4|5|6:DATA
Initial S/W Revision	A.02.00

Navigate

Lets you move through the table to edit the desired point

Key Path	**Meas Setup, Limits, Edit**
Notes	There is no value readback on the key
Initial S/W Revision	A.02.00

Frequency

Lets you edit the frequency of the current row.

Key Path	**Meas Setup, Limits, Edit**
Notes	There is no value readback on the key
Initial S/W Revision	A.02.00

Amplitude

Lets you edit the Amplitude of the current row.

Key Path	**Meas Setup, Limits, Edit**
Notes	There is no value readback on the key
Min	–1000 dBm
Max	1000 dBm
Initial S/W Revision	A.02.00

Insert Point Below

Pressing this key inserts a point below the current point. The new point is a copy of the current point. And becomes the current point The new point is not yet entered into the underlying table, and the data in the row is displayed in LightGray.

Key Path	**Meas Setup, Limits, Edit**
Initial S/W Revision	A.02.00

Delete Point

This is an immediate action key. It will immediately delete the currently-selected point, whether or not that point is being edited, and select Navigate. The point following the currently-selected point (or the point preceeding if there is none) will be selected.

Key Path	**Meas Setup, Limits, Edit**
Initial S/W Revision	A.02.00

Copy from Limit

Copies an existing limit into the current limit, including all secondary parameters (Description, Associated Trace, Type, Margin, Interpolation, Relative to CF/RL).

Remote Command:	`:CALCulate:LLINe[1]|2|3|4|5|6:COPY LLINE1|LLINE2|LLINE3|LLINE4|LLINE5|LLINE6`
Example:	:CALC:LLINE2:COPY LLINE1 !copies the data from line 1 into line 2.
Notes:	Auto return to the Edit menu.
Initial S/W Revision:	A.02.00

Build from Trace

Builds a limit using an existing trace. This command will overwrite all data in the limit. Since a straight copy would typically have hundreds or thousands of segments, the data will be approximated to better represent a limit line; small excursions whose width is less than 10 trace buckets will sometimes not be captured. Secondary parameters which are not associated with traces (Description, Associated Trace, Type, Margin, Interpolation, Relative to CF/RL) will be unchanged.

When taking a trace in order to build a limit, it will often work well to take the trace with a resolution bandwidth wider than the expected measurement, a video bandwidth lower than the expected measurement, and with the detector set to Max Hold or Min Hold.

Note that an upper limit will be built above the trace, while a lower limit will be built below the trace. If the trace is constant, the limit should pass after being built.

Remote Command:	`:CALCulate:LLINe[1]|2|3|4|5|6:BUILd TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`
Example:	:CALC:LLIN2:BUIL TRACE1 !builds limit line 2 based on the data in trace 1. This will overwrite the data in the table editor.
Notes:	Auto return to Edit menu.
Initial S/W Revision:	A.02.00

Offset

Enters a menu which allows you to offset the limit trace by a specified frequency, time, or amplitude. The offsets will be immediately applied to the limit trace for display and failure calculation; the offset can also be applied to the points in the limit line.

Key Path	**Meas Setup, Limits, Edit**
Initial S/W Revision	A.02.00

X Offset

Offsets the limit trace by some specified frequency (for Frequency-based limit lines) or a time (for time-based limit lines).

Key Path	**Meas Setup, Limits, Edit, Offset**

Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:OFFSet:X <value>`
	`:CALCulate:LLINe[1]|2|3|4|5|6:OFFSet:X?`
	<value> = <freq> if Limit X-Axis Unit is Frequency, <value> = <time> if Limit X-Axis Unit is Time

Example	:CALC:LLIN:OFFS:X –50MHZ !sets the X axis offset to –50 MHz. :CALC:LLIN:OFFS:UPD !will apply the X axis offset to all points in the limit line, then reset the X axis offset to zero.
Preset	0 Hz if Limit X-Axis Unit is Frequency 0 S if Limit X-Axis Unit is Time
State Saved	Saved in State, survives Preset
Min	–500 GHz
Max	500 GHz
Default Unit	Determined by X axis scale.
Initial S/W Revision	A.02.00

Y Offset

Offsets all segments in the limit line by some specified amplitude.

Key Path	**Meas Setup, Limits, Edit, Offset**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:OFFSet:Y <rel ampl>` `:CALCulate:LLINe[1]|2|3|4|5|6:OFFSet:Y?`
Example	:CALC:LLIN:OFFS:Y –3 dB !sets the Y axis offset to –3 dB. :CALC:LLIN:OFFSet:UPD !will apply the Y axis offset to all points in the limit line, then reset the Y axis offset to zero.
Preset	0 dB
State Saved	Saved in instrument state.
Min	-Infinity
Max	+Infinity
Default Unit	dB
Initial S/W Revision	A.02.00

Apply Offsets to Limit Table

Adds the X and Y offsets to each point in the limit table, then resets the X and Y offset values to zero. This has no effect on the position of the limit trace.

For example, if the X offset is –10 MHz and the Y offset is 1 dB, the values in the limit table will be updated as follows: 10 MHz will be subtracted from each X value, 1 dB will be added to each Y value. The offset values will then be reset to zero. The limit trace will not be moved and the limit table will be updated to accurately reflect the currently-displayed limit trace.

Key Path	**Meas Setup, Limits, Edit, Offset**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:OFFSet:UPDate`
Example	:CALC:LLIN:OFFS:UPD !sets updates the limit table to reflect the X and Y offsets, then resets the offsets to zero.
State Saved	No state
Initial S/W Revision	A.02.00

Scale X Axis

Matches the X Axis to the selected Limit, as well as possible.

For frequency limits and a frequency-domain X-axis, sets the Start and Stop Frequency to contain the minimum and maximum Frequency of the selected Limit. The range between Start Frequency and Stop Frequency is 12.5% above the range between the minimum and maximum Frequency so that span exceeds this range by one graticule division on either side.

For time limits and a time-domain X-axis, sets the sweep time to match the maximum Time of the selected Limit.

If the domain of the selected limit does not match the domain of the X Axis, no action is taken. Standard clipping rules apply, if the value in the table is outside the allowable range for the X axis.

Key Path	**Meas Setup, Limits, Edit**
Initial S/W Revision	A.02.00

Delete Limit

Deletes the currently selected limit line. Pressing Delete Limit purges the data from the limit line tables.

Limit data – including secondary parameters such as description, margin value, etc. - will be cleared and returned to factory preset settings.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete limit. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message “Limit deleted” appears in the MSG line.

Key Path	**Meas Setup, Limits**
Remote Command	`:CALCulate:LLINe[1]|2|3|4|5|6:DELete`
Example	:CALC:LLIN2:DEL !deletes all data for limit line 2.
Initial S/W Revision	A.02.00

Test Limits

Selects whether displayed traces are tested against displayed limits (i.e. those for which Limit On/Off is set to On).

For each displayed trace for which a Limit is turned on, a message will be displayed in the upper-left corner of the graticule to notify whether the trace passes or fails the limits.

If the trace is at or within the bounds of all applicable limits and margins, the text “Trace x Pass” will be displayed in green, where x is the trace number. A separate line is used for each reported trace.

If the trace is at or within the bounds of all applicable limits, but outside the bounds of some applicable margin, the text “Trace x Fail Margin” will be displayed in amber, where x is the trace number. A separate line is used for each reported trace.

If the trace is outside the bounds of some applicable limits, the the text “Trace x Fail” will be displayed in red, where x is the trace number. A separate line is used for each reported trace.

If the trace has no enabled limits, or the trace itself is not displayed, no message is displayed for that trace.

The PASS/FAIL box in the corner of the Meas Bar is only displayed if there is at least one “Trace Pass/Fail” indication displayed in the graticule.

If two amplitude values are entered for the same frequency, a single vertical line is the result. In this case, if an upper line is chosen, the lesser amplitude is tested. If a lower line is chosen, the greater amplitude is tested.

This command only affects the display, and has no impact on remote behavior. Limit queries over SCPI test the trace against the limit regardless of whether the trace or the limit is turned on (exception: the query :CALCulate:TRACe[1]|2|3|4|5|6:FAIL? tests only the limits that are turned on for that trace).

Key Path	**Meas Setup, Limits**
Remote Command	`:CALCulate:LLINe:TEST OFF|ON|0|1` `:CALCulate:LLINe:TEST?`
Example	:CALC:LLIN:TEST ON !turns on testing, and displays the results in the upper left corner.
Preset	On, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

X-Axis Unit

Selects how the limit-line segments are defined. Pressing X Axis Unit selects whether the limit lines will be entered using frequency (Freq) or sweep time (Time) to define the segments. They can be specified as a table of limit-line segments of amplitude versus frequency, or of amplitude versus time.. When the X-Axis Unit is set to Time, a time value of zero corresponds to the start of the sweep, which is at the left edge of the graticule, and the column and softkey in the Limit Table Editor will read Time instead of Frequency

Switching the limit-line definition between Freq and Time will erase all of the current limit lines. When you do this from the front panel, a warning dialog will pop up letting you know that you are about to erase all the limit lines, and prompting you to hit “OK” if you are sure:

Changing the X Axis Unit will erase all your limit lines. Are you sure you want to do this? Press **Enter** or **OK** to proceed, or **Cancel(Esc)** to cancel.

Key Path	**Meas Setup, Limits**
Remote Command	`:CALCulate:LLINe:CONTrol:DOMain FREQuency|TIME` `:CALCulate:LLINe:CONTrol:DOMain?`
Example	:CALC:LLIN:CONT:DOM FREQ !deletes all currently existing limit lines, then sets all limit lines to be specified in terms of frequency.
Couplings	This affects all limit lines simultaneously, and resets all limit line data except the .wav file and email address stored in the Actions.
Preset	Freq, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

Delete All Limits

Deletes all limit lines. Pressing Delete All Limits purges the data from all limit line tables.

All limit data will be cleared and returned to factory preset settings.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete all limits. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message “All Limits deleted” appears in the MSG line.

Key Path	**Meas Setup, Limits**
Remote Command	`:CALCulate:LLINe:ALL:DELete`
Example	:CALC:LLIN:ALL:DEL !deletes all data for all limit lines.
Initial S/W Revision	A.02.00

Limit Line Data (Remote Command Only, Backwards Compatibility)

Defines the limit line values, and destroys all existing data. Up to 200 points may be defined for each limit using the following parameters.

<x>Frequency or time values as specified by :Calculate:LLINe:CONTrol:DOMain. Units default to Hz (for frequency) and seconds (for time).

Range: –30 Gs to +30 Gs for time limits, –3 kHz to +350 GHz for frequency limits.

<ampl>Amplitude values units default to dBm. Up to two amplitude values can be provided for each x-axis value, by repeating <x-axis> in the data list.

Range: –1000 dBm to +1000 dBm

<connect> connect values are either "0" or "1." A "1" means this point will be connected to the previously defined point to define the limit line. A "0" means that it is a point of discontinuity and is not connected to the preceding point. The connect value is ignored for the first point.

Remote Command:	`:CALCulate:LLINe[1]|2|3|4|5|6:DATA <x>,<ampl>,<connect>` `:CALCulate:LLINe[1]|2|3|4|5|6:DATA?`
Example:	:CALC:LLIN3:DATA 1E9,–20,0,2E9,–20,1,2E9,–10,1,3E9,–10,1 describes a stair-stepped limit line.
Preset:	Limit line data is cleared by Restore Mode Defaults. However, it survives shutdown/restart of the analyzer application (including power cycle)
State Saved:	Saved in instrument state.
Initial S/W Revision:	A.02.00

Limit Line Fail? (Remote Command Only)

Tests a limit line against its associated trace. Returns a 0 if the trace is within the limit and margin, a 1 if the trace exceeds either the limit or the margin.

Note that this command only tests one limit line – other limit lines are not tested when executing this command. To see whether a trace passed all limits, use :CALCulate:TRACe:FAIL?.

Note this command performs the test regardless of whether the trace or the limit is turned on on the display.

Remote Command:	`:CALCulate:LLINe[1]|2|3|4|5|6:FAIL?`
Example:	:CALC:LLIN:FAIL? returns a zero if limit line 1’s associated trace has no failure, 1 if there is a margin or limit failure.
Initial S/W Revision:	A.02.00

Limit State (Remote Command Only, SCPI standard compatibility)

Sets or queries whether the limit line is tested. This command is identical to :CALC:LLIN[1]|2|3|4|5|6:DISP.

Remote Command:	`:CALCulate:LIMit[1]|2|3|4|5|6:STATe ON|OFF|0|1` `:CALCulate:LIMit[1]|2|3|4|5|6:STATe?`
Example:	:CALC:LIM:STAT ON turns on limit line 1
Couplings:	This command is identical to :CALC:LLIN:DISP Testing is done on all displayed limits if “Test All Limits” is ON.
Preset:	Off (all limits)

State Saved:	Saved in State.
Initial S/W Revision:	A.02.00

Limit Line Control (Remote Command Only, SCPI standard compatibility)

Defines a list of limit line control (frequency or time) values for a given limit line. Up to 2000 points may be defined for each limit using the following parameters.

<x>Frequency or time values as specified by :Calculate:LLINe:CONTrol:DOMain. Units default to Hz (for frequency) and seconds (for time).

Range: –30 Gs to +30 Gs for time limits, –3 kHz to +1200 GHz for frequency limits.

Note that X values may be repeated if a vertical step in the limit line is desired.

The points query returns the number of points in the control. It should match the number of points in the amplitude, that is, the number of values for the CONTrol axis and for the corresponding UPPer and/or LOWer limit lines must be identical. If one array is larger than the other, the limit trace is built using only as much data as is contained in the smaller array.

An empty array returns not a number (9.91e+37 to a data query), 0 to a POINts query.

Remote Command:	`:CALCulate:LIMit[1]|2|3|4|5|6:CONTrol[:DATA] <x>, <x>, …` `:CALCulate:LIMit[1]|2|3|4|5|6:CONTrol[:DATA]?`
Example:	:CALC:LIM:CONT 1GHz,2GHz,2GHz,3GHz !describes the X values of a stair-stepped limit line.
Preset:	Limit line data is cleared by Restore Mode Defaults.
State Saved:	Saved in instrument state.
Initial S/W Revision:	A.02.00

Remote Command:	`:CALCulate:LIMit[1]|2|3|4|5|6:CONTrol:POINts?`
Example:	:CALC:LIM:CONT:POIN? !returns the number of points in the limit line.
Preset:	Limit line data is cleared by Restore Mode Defaults.
State Saved:	Saved in instrument state.
Initial S/W Revision:	A.02.00

Limit Line Upper / Lower (Remote Command Only, SCPI standard compatibility)

Defines a list of amplitude values for a given limit line. Changing the number of elements in the list spectrum will automatically turn the limit line off. Using the “UPP” syntax defines an upper limit line, using the “LOW” syntax defines a lower limit line. Note that a line may not be simultaneously both upper and lower; the type of the limit line will automatically be changed as appropriate. Up to 200 points may be defined for each limit using the following parameters.

<ampl>Amplitude values units default to dBm.

Range: –200 dBm to +100 dBm

The points query returns the number of points in the amplitude list. It will not be possible to turn on the limit line unless the number of points in the control matches the number of points in the amplitude.

The points query returns the number of points in the amplitude list. It should match the number of points in the control, that is, the number of values for the CONTrol axis and for the corresponding UPPer and/or LOWer limit lines must be identical. If one array is larger than the other, the limit trace is built using only as much data as is contained in the smaller array.

An empty array returns the system error “list is empty” to a data query, 0 to a POINts query.

Remote Command:	:CALCulate:LIMit[1]|2|3|4|5|6:UPPer[:DATA] <ampl>, <ampl>, … :CALCulate:LIMit[1]|2|3|4|5|6:UPPer[:DATA]?
Example:	:CALC:LIM:UPP –10, –10, –20, –20 !describes the amplitude values of an upper limit line
Preset:	Limit line data is cleared by Restore Mode Defaults.
State Saved:	Saved in instrument state.
Initial S/W Revision:	A.02.00

Remote Command:	:CALCulate:LIMit[1]|2|3|4|5|6:UPPer:POINts?
Example:	:CALC:LIM:UPP:POIN? !returns the number of points in the upper limit line.
Preset:	Upper Limit line data/points is cleared by Restore Mode Defaults.
State Saved:	Saved in instrument state.
Initial S/W Revision:	A.02.00

Remote Command:	:CALCulate:LIMit[1]|2|3|4|5|6:LOWer[:DATA] <ampl>, … :CALCulate:LIMit[1]|2|3|4|5|6:LOWer[:DATA]?
Example:	:CALC:LIM:LOW –10, –10, –20, –20 !describes the amplitude values of an lower limit line
Preset:	Limit line data is cleared by Restore Mode Defaults.
State Saved:	Saved in instrument state.
Initial S/W Revision:	A.02.00

Remote Command:	:CALCulate:LIMit[1]|2|3|4|5|6:LOWer:POINts?
Example:	:CALC:LIM:UPP:POIN? !returns the number of points in the lower limit line.
Preset:	Limit line data/points is cleared by Restore Mode Defaults.
State Saved:	Saved in instrument state.

Initial S/W Revision:	A.02.00

Limit Fail? (Remote Command Only, SCPI standard Compatibility)

Tests a limit line against its associated trace. Returns a 0 if the trace is within the limit and margin, a 1 if the trace exceeds either the limit or the margin. This command is identical to ":CALC:LLIN:FAIL?"

Note that this command only tests one limit line – other limit lines are not tested when executing this command. To see whether a trace passed all limits, use :CALCulate:TRACe:FAIL?.

Note this command performs the test regardless of whether the trace or the limit is turned on on the display.

Remote Command:	`:CALCulate:LIMit[1]|2|3|4|5|6:FAIL?`
Example:	:CALC:LIM:FAIL? !returns a zero if limit line 1's associated trace has no failure, 1 if there is a margin or limit failure.
Couplings:	This command is identical to :CALC:LLIN:FAIL?
Initial S/W Revision:	A.02.00

Limit Clear (Remote Command Only, SCPI standard Compatibility)

Clears a limit line, and all associated data. This command is identical to ":CALC:LLIN:DEL"

Remote Command:	`:CALCulate:LIMit[1]|2|3|4|5|6:CLEar`
Example:	:CALC:LIM2:CLE !deletes all data for limit line 2.
Couplings:	This command is identical to :CALC:LLIN:DEL
Initial S/W Revision:	A.02.00

Trace Fail? (Remote Command Only)

Tests a trace against all associated limit lines. Returns a 0 if the trace is within all limits and margins, a 1 if the trace exceed either the limit or the margin. If no limits apply to the selected trace, this will automatically return a 0.

Only applies to limits that are turned on, if a Limit is off it will not be tested. If a Trace is not displaying it will still be tested, and if **Test Limits (All Limits)** is off the Trace will still be tested.

This command ignores limit lines that are assigned to other traces.

Remote Command:	`:CALCulate:TRACe[1]|2|3|4|5|6:FAIL?`
Example:	:CALC:TRAC3:FAIL? !returns a zero if there is no failure, 1 if the trace exceeds either the limit or the margin.
Initial S/W Revision:	A.02.00

Fixed / Relative Limit (Remote Command Only, Backwards Compatibility)

This command sets both Relative to CF and Relative to RL simultaneously for all limits. If queried, it returns whether Limit Line 1 is set Relative to CF, and ignores all other fixed/relative data.

Remote Command:	`:CALCulate:LLINe:CMODe FIXed|RELative` `:CALCulate:LLINe:CMODe?`
Example:	:CALC:LLIN:CMOD REL !makes all limit lines relative to the center frequency and reference level.
Notes:	This SCPI command is only supported for Backwards Compatibility. PSA offers only the following softkey, which is generic to all limit lines: Limits Fixed / Rel. On the X-Series, this functionality is provided by a softkey which is specific to each limit line, and which provides a sub-menu with 2 softkeys (Relative to CF / Relative to RL). In order to be consistent with the implementation of the following new commands: :CALCulate:LLINe[1]|2|3|4|5|6:FREQuency:CMODe:RELative ON|OFF|1|0 :CALCulate:LLINe[1]|2|3|4|5|6:FREQuency:CMODe:RELative? and :CALCulate:LLINe[1]|2|3|4|5|6:AMPLitude:CMODe:RELative ON|OFF|1|0 :CALCulate:LLINe[1]|2|3|4|5|6:AMPLitude:CMODe:RELative? The :CALCulate:LLINe:CMODe? Query will returns 1 if Limit Line 1 is set Relative to CF, and returns 0 otherwise.
Preset:	Fixed
Initial S/W Revision:	A.02.00

Merge Limit Line Data

Adds the points with the specified values to the current limit line, allowing you to merge limit line data. Up to two amplitude values are allowed for each X value. If more than 200 points are entered to be merged, the first 200 points are merged, then an error 'too many DATA entries' is reported.

Remote Command:	`:CALCulate:LLINe[1]|2|3|4|5|6:DATA:MERGe <x-axis>,<ampl>,<connected>`
Example:	:CALC:LLIN1:DATA:MERG 1000000000,–20,0,2000000000,–30,1 !merges the 10GHz segment and the 20GHz segment into limit line 1. Note that the 20GHz segment will be connected to the next lower point, which may or may not be the 10GHz point.
Notes:	This SCPI command is only supported for Backwards Compatibility. Although PSA had a limit of 200 points, it is acceptable to increase that limit.
Preset:	Fixed
Initial S/W Revision:	A.02.00

N dB Points

Turns N dB points on and off and allows you to set the N dB value. N dB uses the selected marker. If the selected marker is not on when N dB is turned on, the selected marker turns on, as a Normal marker, at center screen, and is used by N dB.

See "N dB Points Results Query" on page 193.

See "More Information" on page 193.

Key Path	**Meas Setup**

Remote Command	`:CALCulate:BWIDth|BANDwidth:NDB <rel_ampl>`
	`:CALCulate:BWIDth|BANDwidth:NDB?`
	`:CALCulate:BWIDth|BANDwidth[:STATe] OFF|ON|0|1`
	`:CALCulate:BWIDth|BANDwidth[:STATe]?`

Notes	If the selected marker is turned **Off** it turns off N dB Points. N DB Points is unaffected by Auto Couple
Preset	Off, 3.01 dB OFF
Preset	Off, 3.01 dB OFF
State Saved	The on/off status and the offset value are both saved in instrument state.
Min	–140 dB
Max	–0.01 dB
Initial S/W Revision	Prior to A.02.00

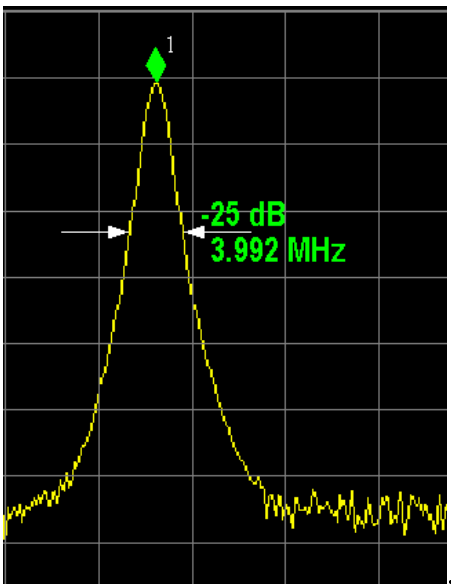
N dB Points Results Query

Remote Command:	`:CALCulate:BWIDth|BANDwidth:RESult?`
Example:	:CALC:MARK:AOFF set selected marker to 1 :CALC:MARK:MAX put marker 1 on peak :CALC:BWID ON turn on N dB for the selected marker (1) :CALC:BWID:NDB–3.01 set the offset to –3.01 dB :CALC:BWID:RES? Query the result
Notes:	–100 returned if invalid reading
Initial S/W Revision:	Prior to A.02.00

More Information

A marker should be placed on the peak of interest before turning on N dB points. The N dB points function looks for the two points on the marker's trace closest to the marker's X Axis value that are N dB below the marker's amplitude, one above and the other below the marker's X Axis value. (That is, one point is to the right and one is to the left of the selected marker.) The selected N dB value is called the offset. The function reports the frequency difference (for frequency domain traces) or time difference (for time domain traces) between those two points.

Each point is identified by a horizontal arrow pointing towards the marker, next to the trace. The arrows used by the N dB Points function will be as shown in the figure below (where each square represents one pixel). They point in, horizontally, at the trace below a peak, on either side of its skirts. There is one pixel between the arrow and the trace

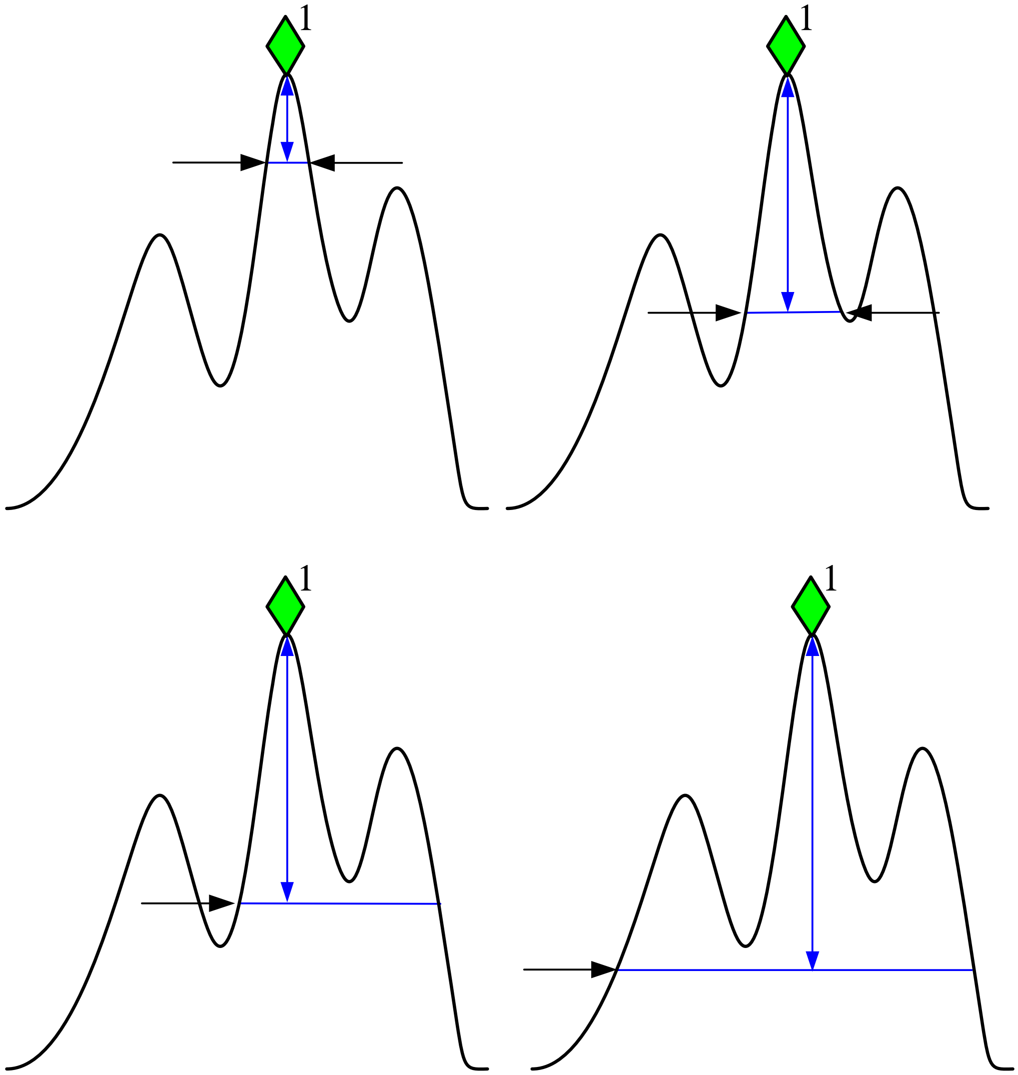


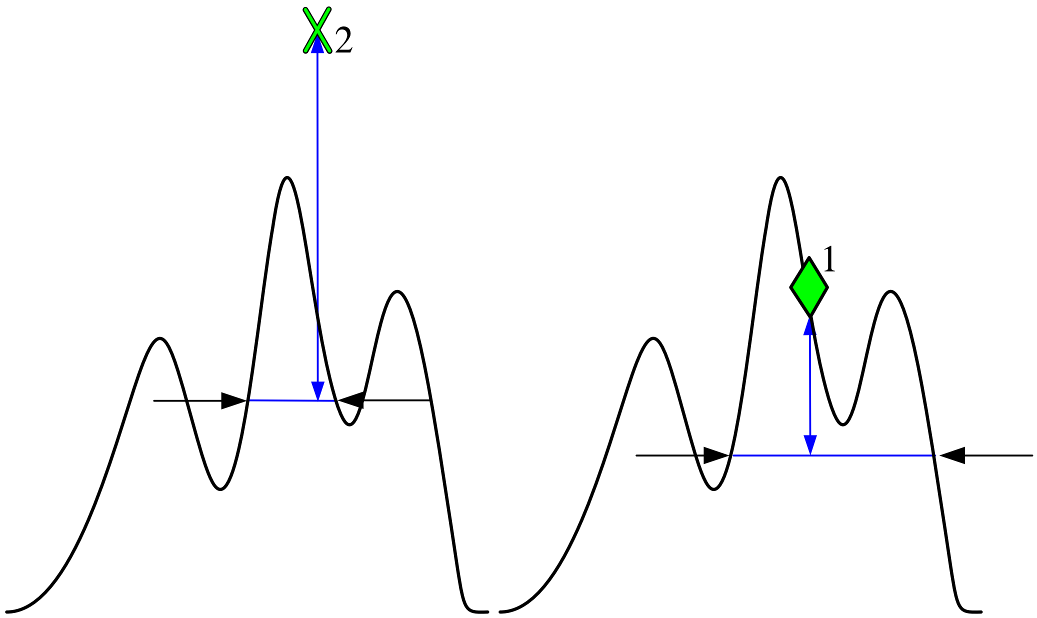
N dB Points can be used to measure the bandwidth of a signal; it is commonly used in conjunction with a tracking generator to measure filter bandwidths.

In one of the common use cases, the marker is placed on a peak, and the arrows are displayed N dB down the skirt from the marker on either side of the peak. The N dB value and the frequency difference between the two arrows is displayed around the arrow as shown in the figure above. Normally this displays on the right hand arrow, but if this would place any part of the text offscreen to the right then it displays on the left arrow.

If the analyzer is unable to find data that is N dB below the marker on either side of the marker, the arrows are displayed at the indicator point of the marker, no value (---) will be displayed as the result and –100 Hz returned remotely (see figure below):

Some sample N dB scenarios are shown below, to illustrate how the function works in various cases. In each case, the two-headed blue arrow represents N dB of amplitude.





PhNoise Opt

Selects the LO (local oscillator) phase noise behavior for various desired operating conditions.

Remote Command:	`[:SENSe]:FREQuency:SYNThesis[:STATe] 1|2|3` `[:SENSe]:FREQuency:SYNThesis[:STATe]?`
Example:	FREQ:SYNT 2 selects optimization for best wide offset phase noise
Notes:	Parameter: 1 - optimizes phase noise for small frequency offsets from the carrier. 2 - optimizes phase noise for wide frequency offsets from the carrier. 3 - optimizes LO for tuning speed (In PXA, the local oscillator hardware provides for extra-low phase noise at the expense of some speed. In these models, the “fast tuning” option lets you go faster at the expense of some noise. In all other models, the fastest possible tuning is the same as the close-in phase noise setting; in those models, the settings for option 1 are used if option 3 is selected.)
Preset:	Because this function is in Auto after preset, and because Span after preset > 314.16 kHz (see Auto rules, next section) the state of this function after Preset will be 2
Dependencies:	Does not appear in all models. The key is blank in those models, but the SCPI command is accepted for compatibility (although no action is taken).
Initial S/W Revision:	Prior to A.02.00
Modified at S/W Revision:	A.02.00

Auto

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions.

The X-Series has two grades of LO; a high performance LO that gives the best phase noise performance; and a medium-performance LO that gives excellent performance.

In models with the high performance LO, Auto will choose:

Fast Tuning whenever Span > 44.44 MHz or RBW > 1.9 MHz

otherwise, if center frequency is < 195 kHz OR ALL of the following are true:

CF 1 MHz AND Span 1.3 MHz AND RBW 75 kHz

then Best Close in Phase Noise;

otherwise, Best Wide-offset Phase Noise

In models with the medium-performance LO, Auto will choose:

Fast Tuning whenever Span > 12.34 MHz or RBW > 250 kHz

otherwise, if center frequency is < 25 kHz OR ALL of the following are true:

CF >= 1 MHz AND Span <= 141.4 kHz AND RBW <= 5 kHz

then **Best Close in Phase Noise**;

otherwise, **Best Wide-offset Phase Noise**

In units whose hardware does not provide for an extra-fast tuning option, the settings for Fast Tuning are the same as Best Close-in, so in those models you will see no difference between these settings.

These rules apply whether in swept spans, zero span, or FFT spans.

Key Path	**Meas Setup, PhNoise Opt**
Remote Command	`[:SENSe]:FREQuency:SYNThesis:AUTO[:STATe] OFF|ON|0|1` `[:SENSe]:FREQuency:SYNThesis:AUTO[:STATe]?`
Example	FREQ:SYNT:AUTO ON
Preset	ON
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Best Close-in P Noise

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

Key Path	**Meas Setup, PhNoise Opt**
Example	FREQ:SYNT 1

Couplings	The frequency below which the phase noise is optimized is model dependent: CXA: n/a EXA: [offset <20 kHz] MXA: [offset <20 kHz] PXA: [offset <140 kHz]
Readback	Close-in. If manually selected the “Man” will be underlined. The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some analyzers this annotation appears as [offset <20 kHz]
Initial S/W Revision	Prior to A.02.00

Best Wide-offset Noise

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

Key Path	**Meas Setup, PhNoise Opt**
Example	FREQ:SYNT 2
Couplings	The frequency below which the phase noise is optimized is model dependent: CXA: n/a EXA: [offset >30 kHz] MXA: [offset >30 kHz] PXA: [offset >160 kHz]
Readback	Wide-offset. If manually selected the “Man” will be underlined. The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some analyzers this annotation appears as [offset >30 kHz]
Initial S/W Revision	Prior to A.02.00

Fast Tuning

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term “fast tuning” refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

In this mode in PXA, the LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

(In models whose hardware does not provide for a fast tuning option, the settings for Best Close-in P Noise are used if Fast Tuning is selected. This gives the fastest possible tuning for that hardware set.)

Key Path	**Meas Setup, PhNoise Opt**
Example	FREQ:SYNT 3
State Saved	Saved in instrument state.
Readback	Fast Tuning. Also, the "Man" must be underlined.
Initial S/W Revision	Prior to A.02.00

ADC Dither

Accesses the menu to control the ADC Dither function. The dither function enhances linearity for low level signals at the expense of reduced clipping-to-noise ratio. The reduced clipping-to-noise ratio results in higher noise, because we work to ensure that the clipping level of the ADC relative to the front terminals remains unchanged with the introduction of dither, and this results in reduced ADC dynamic range. So making measurements with ADC dither gives you better amplitude linearity, but turning ADC dither off gives you a lower noise floor (better sensitivity).

With dither on, the third-order distortions are usually invisible for mixer levels below –35 dBm. With dither off, these distortions can be visible, with typical power levels of –110 dBm referred to the mixer. Detection nonlinearity can reach 1 dB for dither off at mixer levels around –70 dBm and lower, while the specified nonlinearity is many times smaller with dither on.

When ADC Dither is on, the linearity of low-level signals is improved. The enhanced linearity is mostly improved scale fidelity. The linearity improvements of dither are most significant for RBWs of 3.9 kHz and less in swept mode, and FFT widths of 4 kHz and less in FFT mode.

The increased noise due to turning dither on is most significant in low band (0 to 3.6 GHz) with IF Gain set to Low, where it can be about 0.2 dB.

Key Path	**Meas Setup**
Example	ADC:DITH:HIGH !Sets the ADC dither setting to High ADC:DITH ON ! Sets the ADC dither setting to Medium In older instruments the "Medium" key was labeled "On" and the SCPI for this setting is NOT changing.
Remote Command	`[:SENSe]:ADC:DITHer[:STATe] OFF|ON|HIGH` `[:SENSe]:ADC:DITHer[:STATe]?`
Dependencies	In some models, the "High" parameter is not available. In some instruments, the HIGH parameter is honored and the HIGH state set, and returned to a query, but the Medium dither level is actually used.
Preset	AUTO

Backwards Compatibility SCPI	The old command [:SENSe]:ADC:DITHer AUTO is aliased to [:SENSe]:ADC:DITHer:AUTO[:STATe] ON; because of this, the [:SENSe]:ADC:DITHer function cannot be a true Boolean, so the query, [:SENSe]:ADC:DITHer? returns OFF or ON (not 1 or 0 like a true Boolean)
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Auto

Sets the ADC dither to automatic. The analyzer then chooses the dither level according to which is most likely to be the best selection, based on other settings within the digital IF.

When in Auto, the analyzer sets the dither to Medium whenever the effective IF Gain is Low by this definition of IF Gain = Low:

- When Sweep Type = Swept, IF Gain = Low whenever Swept IF Gain is set to Low Gain, whether by autocoupling or manual selection.
- When Sweep Type = FFT, IF Gain = Low whenever FFT IF Gain is set to "Low Gain," which cannot happen by autocoupling.

Whenever the IF Gain is not low by this definition, Auto sets the dither to Off.

Key Path	**Meas Setup, ADC Dither**
Remote Command	`[:SENSe]:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1` `[:SENSe]:ADC:DITHer:AUTO[:STATe]?`
Example	ADC:DITH:AUTO ON
Preset	ON
State Saved	Saved in instrument state
Readback	The “Auto” is underlined, and the readback value is whatever setting is auto-selected
Initial S/W Revision	Prior to A.02.00

High (Best Log Accy)

When ADC dither is set to High, the scale fidelity is especially good, most notably the relative scale fidelity. The tradeoff is that there is a modest loss of noise floor performance, up to about a decibel.

Key Path	**Meas setup, ADC Dither**
Example	ADC:DITH:HIGH
Readback	If manually selected, the readback is High, with the “Man” underlined
Initial S/W Revision	A.02.00

Medium (Log Accy)

The Medium setting of ADC Dither (known as “On” in earlier versions of the instrument software) improves the linearity of low-level signals at the expense of some noise degradation.

Key Path	**Meas setup, ADC Dither**
Example	ADC:DITH:ON
Readback	If manually selected, the readback is Medium, with the “Man” underlined
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Off (Best Noise)

When ADC Dither is Off, the instrument noise floor is improved, because without the need to make room for the dither, you get a lower noise floor and better sensitivity.

Key Path	**Meas setup, ADC Dither**
Example	ADC:DITH:OFF
Readback	If manually selected, the readback is Off, with the “Man” underlined.
Initial S/W Revision	Prior to A.02.00

Swept IF Gain

To take full advantage of the RF dynamic range of the analyzer, there is an added switched IF amplifier with approximately 10 dB of gain. When you can turn it on without overloading the analyzer, the dynamic range is always better with it on than off. The **Swept IF Gain** key can be used to set the IF Gain function to Auto, or to High Gain (the extra 10 dB), or to Low Gain. These settings affect sensitivity and IF overloads.

This function is only active when in Swept sweeps. In FFT sweeps, the FFT IF Gain function is used instead.

Key Path	**Meas Setup**
Remote Command	`[:SENSe]:IF:GAIN:SWEPt[:STATe] OFF|ON|0|1` `[:SENSe]:IF:GAIN:SWEPt[:STATe]?`
Example	IF:GAIN:SWEP ON
Notes	where ON = high gain OFF = low gain

Couplings	The 'auto' rules for Swept IF Gain depend on attenuation, preamp state, start and stop frequency and the setting of FFT IF Gain. Set the Swept IF Gain to High (On) when the total input attenuation is 0 dB, the preamp is off, the start frequency is 10 MHz or more, and the FFT IF Gain is autocoupled, or manually set to Autorange, or manually set to High. Also set the Swept IF Gain to High (On) when the total input attenuation is 2 dB or less, the preamp is on, the start frequency is 10 MHz or more, and the stop frequency is 3.6 GHz or less and the FFT IF Gain is autocoupled, or manually set to Autorange, or manually set to High. Under all other circumstances, set the Swept IF Gain to Low (Off). If the sweep type is Swept, the start frequency of the instrument is less than 10 MHz, and you put Swept IF Gain in Manual On, a warning condition is generated and remains in effect as long as this condition exists. The warning message is about a possible IF overload. As with most parameters with an AUTO state, AUTO COUPLE sets it to Auto, and setting any specific value (for example on or off) will set the AUTO state to false.
Preset	Auto after a Preset which yields Off unless the Preamp is on. Auto and Off after Meas Preset.
State Saved	Saved in instrument state.
Readback Line	High Gain or Low Gain
Initial S/W Revision	Prior to A.02.00

Auto

Activates the auto rules for Swept IF Gain

Key Path	**Meas setup**

Remote Command	`[:SENSe]:IF:GAIN:SWEPt:AUTO[:STATe] OFF|ON|0|1`
	
	`[:SENSe]:IF:GAIN:SWEPt:AUTO[:STATe]?`

Example	IF:GAIN:SWEP:AUTO ON
Preset	ON
Initial S/W Revision	Prior to A.02.00

Low Gain (Best for Large Signals)

Forces Swept IF Gain to be off.

Key Path	**Meas setup, ADC Ranging**
Example	IF:GAIN:SWEP OFF
State Saved	Saved in instrument state.
Readback	Low Gain

Initial S/W Revision	Prior to A.02.00

High Gain (Best Noise Level)

Forces Swept IF Gain to be on.

Key Path	**Meas setup, ADC Ranging**
Example	IF:GAIN:SWEP ON
Dependencies	The High setting for **Swept IF Gain** is grayed out when **FFT IF Gain** is manually set to Low (not when Low is chosen by the auto-rules).
State Saved	Saved in instrument state.
Readback	High Gain
Initial S/W Revision	Prior to A.02.00

FFT IF Gain

Accesses the keys to set the ranging in the digital IF when doing FFT sweeps. When in Autorange mode, the IF checks its range once for every FFT chunk, to provide the best signal to noise ratio. You can specify the range for the best FFT speed, and optimize for noise or for large signals.

When the sweep type is FFT and this function is in Autorange, the IF Gain is set ON initially for each chunk of data. The data is then acquired. If the IF overloads, then the IF Gain is set OFF and the data is re-acquired. Because of this operation, the Auto setting uses more measurement time as the instrument checks/resets its range. You can get faster measurement speed by forcing the range to either the high or low gain setting. But you must know that your measurement conditions will not overload the IF (in the high gain range) and that your signals are well above the noise floor (for the low gain range), and that the signals are not changing.

Key Path	**Meas Setup**
Remote Command	`[:SENSe]:IF:GAIN:FFT[:STATe] AUTOrange|LOW|HIGH` `[:SENSe]:IF:GAIN:FFT[:STATe]?`
Couplings	As with most parameters with an AUTO state, AUTO COUPLE sets it to Auto, which then picks AUTOrange, and setting any specific value (AUTOrange, LOW or HIGH) will set the AUTO state to false.
Preset	AUTOrange
State Saved	Saved in instrument state.
Readback Line	Autorange, High Gain or Low Gain
Initial S/W Revision	Prior to A.02.00

Auto

Allows the instrument to pick the FFT IF Gain method as appropriate. This “Auto” state is set by the

Auto Couple key, and it puts it in Autorange.

Key Path	**Meas setup**
Remote Command	[:SENSe]:IF:GAIN:FFT:AUTO[:STATe] OFF|ON|0|1 [:SENSe]:IF:GAIN:FFT:AUTO[:STATe]?
Example	IF:GAIN:FFT:AUTO ON
Preset	ON
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	DISPlay:WINDow[1]:TRACe:Y[:SCALe]:LOG:RANGe:AUTO
Initial S/W Revision	Prior to A.02.00

Autorange (Slower – Follows Signals)

Turns the ADC ranging to automatic which provides the best signal to noise ratio. Autorange is usually preferred over the manual range choices.

Key Path	**Meas setup, FFT IF Gain**
Example	IF:GAIN:FFT AUTOrange
State Saved	Saved in instrument state.
Readback	Autorange
Initial S/W Revision	Prior to A.02.00

Low Gain (Best for Large Signals)

Forces FFT IF Gain to be off.

Key Path	**Meas setup, FFT IF Gain**
Example	IF:GAIN:FFT LOW
State Saved	Saved in instrument state.
Readback	Low Gain
Initial S/W Revision	Prior to A.02.00

High Gain (Best Noise Level)

Forces FFT IF Gain to be on.

Key Path	**Meas setup, FFT IF Gain**
Example	IF:GAIN:FFT HIGH
Dependencies	The High setting for **FFT IF Gain** is grayed out when **Swept IF Gain** is manually set to Low (not when Low is chosen by the auto-rules).

State Saved	Saved in instrument state.
Readback	High Gain
Initial S/W Revision	Prior to A.02.00

Analog Demod Tune & Listen

The Analog Demod Tune & Listen key opens the Analog Demod menu which contains keys to turn the demod function on and off and select modulation type. This key only appears if the N9063A Analog Demod personality is installed and licensed, or if Option EMC is installed and licensed.

When the function is on (set to AM, FM, or PM), the demodulated signal is fed to the analyzer's speaker. Muting and volume control functions are done through the standard Windows speaker volume control interface.

Key Path	**Meas Setup**
Remote Command	`[:SENSe]:DEMod AM|FM|PM|OFF` `[:SENSe]:DEMod?`
Example	DEM AM turns amplitude demodulation function ON
Dependencies	When Tune & Listen is turned on, all active traces are forced to use the same detector. CISPR detectors (QPD, EMI Avg, RMS Avg) and Tune & LIsten are mutually exclusive. No sound output will be heard if one of these detectors is selected.
Preset	OFF
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

AM

Pressing this key, when it is not selected, selects and activates the AM demodulation function. Pressing it a second time branches to the AM Demod menu where AM demodulation settings can be adjusted.

Key Path	**Meas Setup, Analog Demod Tune&Listen**
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Channel BW (AM Demod)

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW key is grayed out and the value displayed on the key matches the current RBW of the instrument. Upon leaving zero span, the non-zero-span setting of Channel BW is restored as well as the flattop filter type.

Key Path	**Meas Setup, Analog Demod Tune&Listen, AM**
Remote Command	`[:SENSe]:DEMod:AM:BANDwidth:CHANnel <freq>` `[:SENSe]:DEMod:AM:BANDwidth:CHANnel?`
Example	DEM:AM:BAND:CHAN 200 kHz
Notes	This key/command is grayed out in zero span.
Dependencies	Unavailable in zero span.
Couplings	In zero span only, the value is set equal to the instrument's current RBW value and it displays that value on the softkey, but the softkey is grayed out.
Preset	30 kHz
State Saved	Saved in instrument state.
Min	390 Hz
Max	8 MHz
Default Unit	Hz
Initial S/W Revision	Prior to A.02.00

FM

Pressing this key, when it is not selected, selects and activates the FM demodulation function. Pressing it a second time branches to the FM Demod menu where FM demodulation settings can be adjusted.

Key Path	**Meas Setup, Analog Demod Tune&Listen**
Example	DEM FM turns frequency demodulation function ON
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Channel BW (FM Demod)

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW key is grayed out and the value displayed on the key matches the current RBW of the instrument. Upon leaving zero span, the previous setting of Channel BW and the flattop filter type are restored.

Key Path	**Meas Setup, Analog Demod Tune&Listen, FM**
Remote Command	`[:SENSe]:DEMod:FM:BANDwidth:CHANnel <freq>` `[:SENSe]:DEMod:FM:BANDwidth:CHANnel?`
Example	DEM:FM:BAND:CHAN 200 MHz
Notes	This key / command is grayed out in zero span
Dependencies	Unavailable in zero span.
Couplings	In zero span only, the value is set equal to the instrument's current RBW value and it displays that value on the softkey, but the softkey is grayed out.
Preset	150 kHz
State Saved	Saved in instrument state.
Min	390 Hz
Max	8 MHz
Default Unit	Hz
Initial S/W Revision	Prior to A.02.00

De-emphasis (FM Demod only)

The De-emphasis setting controls a single-pole filter (6 dB/octave roll off), usually to counter intentional pre-emphasis in the transmitter. When De-emphasis state is OFF the hardware digital filter is bypassed, otherwise the setting is applied

The De-emphasis softkey is only available when FM is the demod selected. It is grayed out for AM and PM.

Key Path	**Meas Setup, Analog Demod Tune & Listen, FM**
Remote Command	`[:SENSe]:DEMod:FM:DEEMphasis OFF|US25|US50|US75|US750` `[:SENSe]:DEMod:FM:DEEMphasis?`
Example	DEM:FM:DEEM US75 DEM:FM:DEEM?
Dependencies	Only available in FM. Grayed out for AM and PM.
Preset	US75 (recommended for US commercial FM 75 μs pre-emphasis)
State Saved	Saved in instrument state.
Readback line	1-of-N selection
Initial S/W Revision	Prior to A.02.00

Off

This setting bypasses the De-emphasis filter.

Key Path	**Meas Setup, Analog Demod Tune&Listen, FM, De-emphasis**
Example	DEM:FM:DEEM OFF
Readback	Off
Initial S/W Revision	Prior to A.02.00

25 µs

Sets the De-emphasis time constant to 25µµs.

Key Path	**Meas Setup, Analog Demod Tune&Listen, FM, De-emphasis**
Example	DEM:FM:DEEM US25
Readback	25 µs
Initial S/W Revision	Prior to A.02.00

50 µs

Sets the De-emphasis time constant to 50 µs.

Key Path	**Meas Setup, Analog Demod Tune&Listen, FM, De-emphasis**
Example	DEM:FM:DEEM US50
Readback	50 µs
Initial S/W Revision	Prior to A.02.00

75 µs

Sets the De-emphasis time constant to 75 µs.

Key Path	**Meas Setup, Analog Demod Tune&Listen, FM, De-emphasis**
Example	DEM:FM:DEEM US75
Readback	75 µs
Initial S/W Revision	Prior to A.02.00

750 µs

Sets the De-emphasis time constant to 750 µsec.

Key Path	**Meas Setup, Analog Demod Tune&Listen, FM, De-emphasis**
Example	DEM:FM:DEEM US750
Readback	750 µs

Initial S/W Revision	Prior to A.02.00

PM

Pressing this key, when it is not selected, selects and activates the PM demodulation function. Pressing it a second time branches to the PM Demod menu where PM demodulation settings can be adjusted.

Key Path	**Meas Setup, Analog Demod Tune&Listen**
Example	DEM PM turns Phase demodulation function ON
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Channel BW (PM Demod)

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW key is grayed out and the value displayed on the key matches the current RBW of the instrument. Upon leaving zero span, the previous setting of Channel BW and the flattop filter type are restored.

Key Path	**Meas Setup, Analog Demod Tune&Listen, M**
Remote Command	`[:SENSe]:DEMod:PM:BANDwidth:CHANnel <freq>` `[:SENSe]:DEMod:PM:BANDwidth:CHANnel?`
Example	DEM:PM:BAND:CHAN 200 MHz
Notes	This key / command is grayed out in zero span
Dependencies	Unavailable in zero span.
Couplings	In zero span only, the value is set equal to the instrument's current RBW value and it displays that value on the softkey, but the softkey is grayed out.
Preset	100 kHz
State Saved	Saved in instrument state.
Min	390 Hz
Max	8 MHz
Default Unit	Hz
Initial S/W Revision	Prior to A.02.00

Off

Pressing this key, turns the demodulation function off.

Key Path	**Meas Setup, Analog Demod Tune&Listen**
Example	DEM OFF turns the demodulation function OFF
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Demod Time

Sets the amount of time the instrument demodulates the signal after each sweep. The demodulated signal can be heard through the speaker during demodulation. In zero span, demodulation can be performed continuously, making this parameter not applicable, hence it is grayed out in zero span.

Key Path	**Meas Setup, Analog Demod Tune&Listen**
Remote Command	`[:SENSe]:DEMod:TIME <time>` `[:SENSe]:DEMod:TIME?`
Example	DEM:TIME 500 ms DEM:TIME?
Notes	This key / command is grayed out in zero span
Dependencies	Unavailable in zero span.
Preset	500 ms
State Saved	Saved in instrument state.
Min	2 ms
Max	100 s
Initial S/W Revision	Prior to A.02.00

Demod State (Remote Command Only)

Sets or queries the state of the Analog Demod Tune and Listen function. Setting the state to ON with this command will select AM demodulation by default and activate it (turn it on).

The response to the query is determined by the current setting of [:SENSE]:DEMod AM|FM|PM|OFF. The response will be 1 if AM, FM, PM are selected, or 0 if OFF is selected..

Remote Command:	`[:SENSe]:DEMod:STATe OFF|ON|0|1` `[:SENSe]:DEMod:STATe?`
Preset:	OFF
Initial S/W Revision:	Prior to A.02.00

Noise Source

This menu allows you to turn the noise source power on or off when making manual noise figure measurements. It is included in the Spectrum Analyzer Mode as an adjunct to the full controls that are available in the Noise Figure Mode. It is only available in the Swept SA measurement of the Spectrum Analyzer Mode.

See "More Information" on page 211.

Key Path	**Meas Setup**
Remote Command	`:SOURce:NOISe:TYPE NORMal | SNS` `:SOURce:NOISe:TYPE?`
Example	SOUR:NOIS:TYPE NORM
Couplings	If no SNS is connected, this parameter will be set to "Normal" When Type is set to "SNS" and the SNS is disconnected, this parameter gets bumped to "Normal" When an SNS is not connected, the SNS type will be grayed (disabled).
Preset	Normal
State Saved	Saved in instrument state.
Range	Normal | SNS
Remote Compatibility Info	In previous Noise Figure analysis applications, this command could optionally be preceded with the :SENSe keyword. The optional :SENSe keyword is no longer supported.
Initial S/W Revision	Prior to A.02.00

More Information

There are 2 types of noise sources: a Smart Noise Source (SNS), and a "Normal" noise source - e.g. 346 series. This menu allows the user to control both. The SNS has its own connector on the rear of the analyzer and when it is connected the user can then select it from the "Type" 1 of N, allowing the State parameter to then control the SNS. The "Normal" source is controlled by a BNC connector that supplies 28V. If SNS is NOT connected then the "state" parameter controls the "Normal" noise source 28V BNC port. If both are connected the "Type" parameter will determine which source the "State" parameter will control. Two sources can never be controlled together. The "SNS attached" SCPI query detailed below can be used remotely to determine if an SNS is connected. SNS functionality is limited to turning on and off only. The SNS ENR data and temperature cannot be queried, unless the Noise Figure application is installed. The SNS ENR data is issued in printed form when an SNS is purchased or can be read from the analyzer's Noise Figure application if installed, or other Agilent noise figure instruments that support the SNS (NFA and ESA with option 219).

When first entering the Swept SA measurement the "State" will be set to OFF and the 28v BNC drive and SNS turned off to ensure the two are in sync. When the Swept SA measurement is exited, the "State" parameter will be set to OFF and the 28v BNC and SNS drive turned off.

For making manual noise figure measurements the following setup is recommended:

Set the SPAN to Zero

Set attenuation to 0 dB

Set the PRE-AMP ON

Set the RBW to 4MHz

Set the Detector to AVERAGE

Set the sweep time to 16ms - sets the variance correctly for good results.

Set a Band/Interval Power Marker function and set the interval over the full width of trace i.e. Left to 0s and Right to 16ms

State

This key turns the Noise Source on and off.

Key Path	**Meas Setup**
Remote Command	`:SOURce:NOISe[:STATe] ON|OFF|1|0` `:SOURce:NOISe[:STATe]?`
Example	SOUR:NOIS OFF
Couplings	1. If an SNS is connected, and the Type is set to SNS, this parameter turns the SNS on and off. 2. When an SNS is not connected this parameter turns the BNC 28V output on and off. 3. When the SA mode is first entered this parameter is set to OFF and the 28v drive turned OFF. 4. When the SA mode is exited this parameter is set to OFF and the 28v drive turned OFF.
Preset	OFF
State Saved	Saved in instrument state.
Remote Compatibility Info	In previous Noise Figure analysis applications, this command could optionally be preceded with the :SENSe keyword. The optional :SENSe keyword is no longer supported.
Initial S/W Revision	Prior to A.02.00

SNS Attached (Remote Command Only)

If an Smart Noise Source (SNS) is present this command will return 1 otherwise it will return 0.

Remote Command:	`:SOURce:NOISe:SNS:ATTached?`
Example:	SOUR:NOIS:SNS:ATT?
Preset:	OFF
State Saved:	No

Remote Compatibility Info:	In previous Noise Figure analysis applications, this command could optionally be preceded with the :SENSe keyword. The optional :SENSe keyword is no longer supported.
Initial S/W Revision:	Prior to A.02.00

Meas Preset

This key returns the Meas Local variables in the Swept SA measurement to their preset values. This is the same as sending the SCPI command CONF:SAN.

The only exception is Limits On/Off, which is a persistent Meas Local variable. It will be set to Off by a Mode Preset but not by Meas Preset.

Key Path	**Meas Setup**
Initial S/W Revision	Prior to A.02.00

Mode

The Mode key allows you to select the available measurement applications or "Modes". Modes are a collection of measurement capabilities packaged together to provide an instrument personality that is specific to your measurement needs. Each application software product is ordered separately by Model Number and must be licensed to be available. Once an instrument mode is selected, only the commands that are valid for that mode can be executed.

NOTE Key operation can be different between modes. The information displayed in Help is about the current mode.

To access Help for a different Mode you must first exit Help (by pressing the Cancel (Esc) key). Then select the desired mode and re-access Help.

For more information on Modes, preloading Modes, and memory requirements for Modes, see "More Information" on page 214

Key Path	**Front-panel key**
Remote Command	`:INSTrument[:SELect] SA|BASIC|WCDMA|CDMA2K|EDGEGSM|PNOISE|CDMA1XEV|CWLAN|WIMAXOFDMA|CWIMAXOFDM|VSA|VSA89601|LTE|IDEN|WIMAXFIXED|LTETDD|TDSCDMA|NFIGURE|ADEMOD|DVB|DTMB|ISDBT|CMMB|RLC` `:INSTrument[:SELect]?`
Example	:INST SA
Notes	The available parameters are dependent upon installed and licensed applications resident in the instrument. Parameters given here are an example, specific parameters are in the individual Application. A list of the valid mode choices is returned with the INST:CAT? Query.

Preset	Not affected by Preset. Set to SA following Restore System Defaults, if SA is the default mode.
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Example	:INST ‘SA’
Initial S/W Revision	Prior to A.02.00
Notes	NOTE: The query is not a quoted string. It is an enumeration as indicated in the Instrument Select table above. The command must be sequential: i.e. continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available.
Backwards Compatibility SCPI	:INSTrument[:SELect] ‘SA’|’PNOISE’|’EDGE’|’GSM’|’BASIC’

More Information

The Mode name appears on the banner after the word "Agilent" followed by the Measurement Title. For example, for the Spectrum Analyzer mode with the Swept Sa measurement running:

It is possible to specify the order in which the Modes appear in the Mode menu, using the Configure Applications utility (System, Power On, Configure Applications). It is also possible, using the same utility, to specify a subset of the available applications to load into memory at startup time, which can significantly decrease the startup time of the analyzer. During runtime, if an application that is not loaded into memory is selected (by either pressing that applications Mode key or sending that applications :INST:SEL command over SCPI), there will be a pause while the Application is loaded. During this pause a message box that says "Loading application, please wait…" is displayed.

Each application (Mode) that runs in the X-Series signal analyzers consumes virtual memory. The various applications consume varying amounts of virtual memory, and as more applications run, the memory consumption increases. Once an application is run, some of its memory remains allocated even when it is not running, and is not released until the analyzer program (xSA.exe) is shut down.

Agilent characterizes each Mode and assigns a memory usage quantity based on a conservative estimate. There is a limited amount of virtual memory available to applications (note that this is virtual memory and is independent of how much physical RAM is in the instrument). The instrument keeps track of how much memory is being used by all loaded applicationss - which includes those that preloaded at startup, and all of those that have been run since startup.

When you request a Mode that is not currently loaded, the instrument looks up the memory estimate for that Mode, and adds it to the residual total for all currently loaded Modes. If there is not enough virtual memory to load the Mode, a dialog box and menu will appear that gives you four options:

1.Close and restart the analyzer program without changing your configured preloads. This may free up enough memory to load the requested Mode, depending on your configured preloads

2.Clear out all preloads and close and restart the analyzer program with only the requested application preloaded, and with that application running. This choice is guaranteed to allow you to run the requested application; but you will lose your previously configured preloads. In addition, there may be little or no room for other applications, depending on the size of the requested application.

3.Bring up the Configure Applications utility in order to reconfigure the preloaded apps to make room for the applications you want to run (this will then require restarting the analyzer program with your new configuration). This is the recommended choice because it gives you full flexibility to select exactly what you want.

4.Exit the dialog box without doing anything, which means you will be unable to load the application you requested.

In each case except 4, this will cause the analyzer software to close, and you will lose all unsaved traces and results.

If you attempt to load a mode via SCPI that will exceed memory capacity, the Mode does not load and an error message is returned:

-225,"Out of memory;Insufficient resources to load Mode (mode name)"

where "mode name" is the SCPI parameter for the Mode in question, e.g. SA for Spectrum Analyzer Mode

Application Mode Number Selection (Remote Command Only)

Select the measurement mode by its mode number. The actual available choices depend upon which applications are installed in your instrument. The modes appear in this table by NSEL number, which is not the same as their order in the Mode menu (see “Detailed List of Modes” on page 219 for the mode order).

Mode	:INSTrument:NSELect <integer>	:INSTrument[:SELect] <parameter>
Spectrum Analyzer	1	SA
I/Q Analyzer (Basic)	8	BASIC
WCDMA with HSDPA/HSUPA	9	WCDMA
cdma2000	10	CDMA2K
GSM/EDGE/EDGE Evo	13	EDGEGSM
Phase Noise	14	PNOISE
1xEV-DO	15	CDMA1XEV
Combined WLAN	19	CWLAN
802.16 OFDMA (WiMAX/WiBro)	75	WIMAXOFDMA
Combined Fixed WiMAX	81	CWIMAXOFDM
Vector Signal Analyzer (VXA)	100	VSA
89601 VSA	101	VSA89601
LTE	102	LTE

iDEN/WiDEN/MotoTalk	103	IDEN
802.16 OFDM (Fixed WiMAX)	104	WIMAXFIXED
LTE TDD	105	LTETDD
TD-SCDMA with HSPA/8PSK	211	TDSCDMA
Noise Figure	219	NFIGURE
Analog Demod	234	ADEMOD
DVB-T/H	235	DVB
DTMB	236	DTMB
ISDB-T	239	ISDBT
CMMB	240	CMMB
Remote Language Compatibility	266	RLC

Remote Command:	`:INSTrument:NSELect <integer>` `:INSTrument:NSELect?`
Example:	:INST:NSEL 1
Notes:	SA mode is 1 The command must be sequential: i.e. continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available.
Preset:	Not affected by Preset. Set to default mode (1 for SA mode) following Restore System Defaults.
State Saved:	Saved in state
Initial S/W Revision:	Prior to A.02.00

Application Mode Catalog Query (Remote Command Only)

Returns a string containing a comma separated list of names of all the installed and licensed measurement modes (applications). These names can only be used with the :INSTrument[:SELect] command.

Remote Command:	`:INSTrument:CATalog?`
Example:	:INST:CAT?
Notes:	Query returns a quoted string of the installed and licensed modes separated with a comma. Example: "SA,PNOISE,WCDMA"
Initial S/W Revision:	Prior to A.02.00

Application Identification (Remote Commands Only)

Each entry in the Mode Menu will have a Model Number and associated information: Version, and Options.

This information is displayed in the Show System screen. The corresponding SCPI remote commands are defined here.

Current Application Model

Returns a string that is the Model Number of the currently selected application (mode).

Remote Command:	`:SYSTem:APPLication[:CURRent][:NAME]?`
Example:	:SYST:APPL?
Notes:	Query returns a quoted string that is the Model Number of the currently selected application (Mode). Example: "N9060A" String length is 6 characters.
Preset:	Not affected by Preset
State Saved:	Not saved in state, the value will be the selected application when a Save is done.
Initial S/W Revision:	Prior to A.02.00

Current Application Revision

Returns a string that is the Revision of the currently selected application (mode).

Remote Command:	`:SYSTem:APPLication[:CURRent]:REVision?`
Example:	:SYST:APPL:REV?
Notes:	Query returns a quoted string that is the Revision of the currently selected application (Mode). Example: "1.0.0.0" String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points)
Preset:	Not affected by a Preset
State Saved:	Not saved in state, the value will be the selected application when a Save is done.
Initial S/W Revision:	Prior to A.02.00

Current Application Options

Returns a string that is the Options list of the currently selected application (Mode).

Remote Command:	`:SYSTem:APPLication[:CURRent]:OPTion?`
Notes:	Query returns a quoted string that is the Option list of the currently selected application (Mode). The format is the name as the *OPT? or SYSTem:OPTion command: a comma separated list of option identifiers. Example: "1FP,2FP" String length is a maximum of 255 characters.
Preset:	Not affected by a Preset
State Saved:	Not saved in state per se, the value will be the selected application when a Save is invoked.
Example:	:SYST:APPL:OPT?
Initial S/W Revision:	Prior to A.02.00

Application Identification Catalog (Remote Commands Only)

A catalog of the installed and licensed applications (Modes) can be queried for their identification.

Application Catalog number of entries

Returns the number of installed and licensed applications (Modes).

Remote Command:	`:SYSTem:APPLication:CATalog[:NAME]:COUNt?`
Example:	:SYST:APPL:CAT:COUN?
Preset:	Not affected by Preset
State Saved:	Not saved in instrument state.
Initial S/W Revision:	Prior to A.02.00

Application Catalog Model Numbers

Returns a list of Model Numbers for the installed and licensed applications (Modes).

Remote Command:	`:SYSTem:APPLication:CATalog[:NAME]?`
Example:	:SYST:APPL:CAT?
Notes:	Returned value is a quoted string of a comma separated list of Model Numbers. Example, if SAMS and Phase Noise are installed and licensed: "N9060A,N9068A" String length is COUNt * 7 – 1. (7 = Model Number length + 1 for comma. –1 = no comma for the 1st entry.)

Preset:	Not affected by a Preset
State Saved:	Not saved in instrument state.
Initial S/W Revision:	Prior to A.02.00

Application Catalog Revision

Returns the Revision of the provided Model Number.

Remote Command:	`:SYSTem:APPLication:CATalog:REVision? <model>`
Example:	:SYST:APPL:CAT:REV? ‘N9060A’
Notes:	Returned value is a quoted string of revision for the provided Model Number. The revision will be a null-string ("") if the provided Model Number is not installed and licensed. Example, if SAMS is installed and licensed: "1.0.0.0"
Preset:	Not affected by a Preset.
State Saved:	Not saved in instrument state.
Initial S/W Revision:	Prior to A.02.00

Application Catalog Options

Returns a list of Options for the provided Model Number

Remote Command:	`:SYSTem:APPLication:CATalog:OPTion? <model>`
Example:	:SYST:APPL:CAT:OPT? ‘N9060A’
Notes:	Returned value is a quoted string of a comma separated list of Options, in the same format as *OPT? or :SYSTem:OPTion?. If the provided Model Number is not installed and licensed a null-string ("") will be returned. Example, if SAMS is installed and licensed: "2FP" String length is a maximum of 255 characters.
Preset:	Not affected bya Preset
State Saved:	Not saved in instrument state.
Initial S/W Revision:	Prior to A.02.00

Detailed List of Modes

Spectrum Analyzer

Selects the Spectrum Analyzer mode for general purpose measurements. There are several measurements available in this mode. General spectrum analysis measurements, in swept and zero span, can be done using the first key in the Meas menu, labeled Swept SA. Other measurements in the Meas Menu are designed to perform specialized measurement tasks, including power and demod measurements.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL SA INST:NSEL 1
Initial S/W Revision	Prior to A.02.00

IQ Analyzer (Basic)

The IQ Analyzer Mode makes general purpose frequency domain and time domain measurements. These measurements often use alternate hardware signal paths when compared with a similar measurement in the Signal Analysis Mode using the Swept SA measurement. These frequency domain and time domain measurements can be used to output I/Q data results when measuring complex modulated digital signals.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL BASIC INST:NSEL 8
Initial S/W Revision	Prior to A.02.00

W-CDMA with HSDPA/HSUPA

Selects the W-CDMA with HSDPA/HSUPA mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL WCDMA INST:NSEL 9
Initial S/W Revision	Prior to A.02.00

GSM/EDGE/EDGE Evo

Selects the GSM with EDGE mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If

it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Example	INST:SEL EDGEGSM INST:NSEL 13
Initial S/W Revision	Prior to A.02.00
Key Path	**Mode**
Modified at S/W Revision	A.02.00

802.16 OFDMA (WiMAX/WiBro)

Selects the OFDMA mode for general purpose measurements of WiMAX signals. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL WIMAXOFDMA INST:NSEL 75
Initial S/W Revision	Prior to A.02.00

Vector Signal Analyzer (VXA)

The 89601X Vector Signal Analyzer provides vector-signal analysis measurement capability. It provides 3 main measurements that allow you to measure the signal quality of all varieties of RF modulation:

- Digital Demodulation
- Analog Demodulation
- Vector Signal Analysis

There are advanced modulation analysis and troubleshooting capabilities including the following communications formats: AM, FM, PM, WiMAX, W-CDMA, 2G, 3G, 3.5G, WLAN, digital video, and more. It also provides standard-specific measurements for analysis of iDEN, WiDEN, and MotoTalk signals with Option H09.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL VSA INST:NSEL 100
Initial S/W Revision	Prior to A.02.00

Phase Noise

The Phase Noise mode provides pre-configured measurements for making general purpose measurements of device phase noise.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL PNOISE or INST:NSEL 14
Initial S/W Revision	Prior to A.02.00

Noise Figure

The Noise Figure mode provides pre-configured measurements for making general purpose measurements of device noise figure.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL NFIGURE Or INST:NSEL 219
Initial S/W Revision	Prior to A.02.00

Analog Demod

Selects the Analog Demod mode for making measurements of AM, FM and phase modulated signals.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL ADEMOD INST:NSEL 234
Initial S/W Revision	Prior to A.02.00

TD-SCDMA with HSPA/8PSK

Selects the TD-SCDMA mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If

it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL TDSCDMA INST:NSEL 211
Initial S/W Revision	Prior to A.02.00

cdma2000

Selects the cdma2000 mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL CDMA2K INST:NSEL 10
Initial S/W Revision	Prior to A.02.00

1xEV-DO

Selects the 1xEV-DO mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL CDMA1XEV INST:NSEL 15
Initial S/W Revision	Prior to A.02.00

LTE

Selects the LTE mode for general purpose measurements of signals following the LTE FDD standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL LTE INST:NSEL 102

Initial S/W Revision	Prior to A.02.00

LTE TDD

Selects the LTE TDD mode for general purpose measurements of signals following the LTE TDD standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL LTETDD INST:NSEL 105
Initial S/W Revision	A.03.00

DVB-T/H

Selects the DVB-T/H mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL DVB INST:NSEL 235
Initial S/W Revision	A.02.00

DTMB

Selects the DTMB mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL DTMB INST:NSEL 236
Initial S/W Revision	A.02.00

ISDB-T

Selects the ISDB-T mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If

it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL ISDBT INST:NSEL 239
Initial S/W Revision	A.03.00

CMMB

Selects the CMMB mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL CMMB INST:NSEL 240
Initial S/W Revision	A.03.00

Combined WLAN

Selects the CWLAN mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL CWLAN INST:NSEL 19
Initial S/W Revision	A.02.00

Combined Fixed WiMAX

Selects the Combined Fixed WiMAX mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL CWIMAXOFDM INST:NSEL 81

Initial S/W Revision	A.02.00

802.16 OFDM (Fixed WiMAX)

Selects the 802.16 OFDM (Fixed WiMAX) mode. This mode allows modulation quality measurements of signals that comply with IEEE 802.16a–2003 and IEEE 802.16–2004 standards, with flexibility to measure nonstandard OFDM formats. Along with the typical digital demodulation measurement results, several additional 802.16 OFDM unique trace data formats and numeric error data results provide enhanced data analysis.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL WIMAXFIXED INST:NSEL 104
Initial S/W Revision	A.02.00

iDEN/WiDEN/MOTOTalk

Selects the iDEN/WiDEN/MOTOTalk mode for general purpose measurements of iDEN and iDEN-related signals. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**
Example	INST:SEL IDEN INST:NSEL 103
Initial S/W Revision	A.02.00

Remote Language Compatibility

The Remote Language Compatibility (RLC) mode provides remote command backwards compatibility for the 8560 series of spectrum analyzers, known as legacy spectrum analyzers.

NOTE After changing into or out of RLC mode, allow a 1 second delay before sending any subsequent commands.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	**Mode**

Example	INST:SEL RLC Or INST:NSEL 266
Initial S/W Revision	Prior to A.02.00

89601 VSA

Selecting the 89601 VSA mode will start the 89600-Series VSA software application. The 89600 VSA software is powerful, PC-based software, offering the industry's most sophisticated general purpose and standards specific signal evaluation and troubleshooting tools for the R&D engineer. Reach deeper into signals, gather more data on signal problems, and gain greater insight.

- Over 30 general-purpose analog and digital demodulators ranging from 2FSK to 1024QAM
- Standards specific modulation analysis including:
- Cell: GSM, cdma2000, WCDMA, TD-SCDMA and more
- Wireless networking: 802.11a/b/g, 802.11n, 802.16 WiMAX (fixed/mobile), UWB
- RFID
- Digital satellite video and other satellite signals, radar, LMDS
- Up to 400K bin FFT, for the highest resolution spectrum analysis
- A full suite of time domain analysis tools, including signal capture and playback, time gating, and CCDF measurements
- Six simultaneous trace displays and the industry's most complete set of marker functions
- Easy-to-use Microsoft ® Windows ® graphical user interface

For more information see the Agilent 89600 Series VSA web site at www.agilent.com/find/89600

To learn more about how to use the 89600 VSA running in the X-Series, after the 89600 VSA application is running, open the 89600 VSA Help and open the "About Agilent X-Series Signal Analyzers (MXA/EXA) with 89600-Series Software" help topic.

Key Path	**Mode**
Example	INST:SEL VSA89601 INST:NSEL 101
Initial S/W Revision	Prior to A.02.00

Global Settings

Opens up a menu that allows you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. No matter what Mode you are in when you set the “Global Center Frequency” switch to on, it applies to all Modes that support Global Settings.

Key Path	**Mode Setup**

Initial S/W Revision	Prior to A.02.00

Global Center Freq

The software maintains a Mode Global value called "Global Center Freq".

When the **Global Center Freq** key is switched to **On** in any mode, the current mode's center frequency is copied into the Global Center Frequency, and from then on all modes which support global settings use the Global Center Frequency. So you can switch between any of these modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any mode which supports Global Settings, while **Global Center Freq** is **On**, will modify the Global Center Frequency.

When **Global Center Freq** is turned **Off**, the Center Freq of the current mode is unchanged, but now the Center Freq of each mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is **On**, the Global Center Freq is preset to the preset Center Freq of the current mode.

This function is reset to Off when the Restore Defaults key is pressed in the Global Settings menu, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Key Path	**Mode Setup, Global Settings**
Scope	Mode Global
Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL|NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	INST:COUP:FREQ:CENT ALL INST:COUP:FREQ:CENT?
Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On|Off
Initial S/W Revision	Prior to A.02.00

Remote Command:	`:GLOBal:FREQuency:CENTer[:STATe] 1|0|ON|OFF` `:GLOBal:FREQuency:CENTer[:STATe]?`
Preset:	Off
Initial S/W Revision:	Prior to A.02.00

Restore Defaults

This key resets all of the functions in the Global Settings menu to Off. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Key Path	**Mode Setup, Global Settings**

Remote Command	`:INSTrument:COUPle:DEFault`
Example	INST:COUP:DEF
Backwards Compatibility SCPI	:GLOBal:DEFault
Initial S/W Revision	Prior to A.02.00

Mode Setup

The Mode Setup menu contains setup functions that are global across the entire Mode. These functions are independent of which measurement is currently running - they are global to all measurements in the mode, or "Meas Global." The Mode Setup functions are not the only Meas Global functions in the analyzer; for example, the Trigger Setup functions are Meas Global, and there are even Mode Global functions (that is, the same for all Modes) in the Input/Output menu, but the fact that they are all Meas Global is a distinguishing characteristic of the Mode Setup functions.

The Mode Setup menu also contains the **Restore Mode Defaults** key. Most Meas Global functions are restored to their preset values by **Mode Preset**, however some variables are more persistent and are not preset until the **Restore Mode Defaults** key is pressed.

There are also a few Meas Global variables (for example, Global Center Frequency) that can be switched to be Mode Global, that is, the same for all modes. The keys under the Global Settings key control whether these variables are Mode Global or not.

In the Spectrum Analyzer mode, the Mode Setup functions include which radio standard and/or EMC standard is in use and how it is configured. A set of CISPR EMC presets is available as well.

The EMC keys require Option EMC to be installed and licensed.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Radio Standard

Allows you to specify the radio standard to be used. Spectrum Analyzer mode supports many radio standards. Youcan select the desired radio standard using the **Radio Std** key. However, not every measurement in the Spectrum Analyzer mode is available with every standard. The chart below describes which measurements are available with each radio standard.

	None	IS-95A	J-STD-008	IS-97D/98D	GSM/EDGE	3GPP W-CDMA	cdma2000 1x	NADC	PDC	Bluetooth	TETRA	FCC Part 15 Subpart F	W-LAN 802.11a	W-LAN 802.11b	W-LAN 802.11g	W-LAN HiperLAN/2	DVB-T L/SECAM/NICAM	DVBT-T G/PAL/NICAM	DVB-T I/PAL/NICAM	S-DMB System E	UWB Indoor
Swept SA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Channel Power	X	X	X	X		X	X	X	X		X						X	X	X	X	
Occupied BW	X	X	X	X		X	X	X	X											X	
ACP	X	X	X	X		X	X	X	X		X									X	
Power Stat CCDF	X	X	X	X	X	X	X	X	X	X							X	X	X		
Burst Power	X	X	X		X	X	X	X	X	X											
Spurious Emission	X											X									X
Spectrum Emission Mask	X					X							X	X	X	X					

Key Path	**Mode Setup**
Scope	Meas Global
Remote Command	`[:SENSe]:RADio:STANdard[:SELect] NONE|JSTD|IS95a|IS97D|IS98D|GSM|W3GPP|CDMA2000MC1|C2000 1X|NADC|PDC|BLUEtooth|TETRa|WL802DOT11A|WL802DOT11B|WL802DOT11G|HIPERLAN2|DVBTLSN|DVBTGPN|DVBTIPN|FCC15|SDMBSE|UWBINDOOR` `[:SENSe]:RADio:STANdard[:SELect]?`
Example	RAD:STAN NONE RAD:STAN?
Couplings	By changing the radio standard, the measurement parameters will be automatically set to an appropriate default value.
State Saved	Saved in instrument state
Range	None|IS–95A|J-STD–008|IS–97D/98D|GSM/EDGE|3GPP W-CDMA|cdma2000 1x|NADC|PDC|Bluetooth|TETRA|W-LAN|DVB-T|FCC Part 15 Subpart F|S-DMB System E|UWB Indoor
Initial S/W Revision	Prior to A.02.00

Device

Allows you to specify the device to be used. This key appears in the Setup menu of most of the Radio Stds. It is a global setting that affects the Device selection, between Mobile (MS) and Base Station (BTS) settings, for all relevant Power Suite measurements.

Key Path	**Mode Setup, Radio Std Setup**
Scope	Meas Global

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS|MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	RAD:STAN:DEV MS RAD:STAN:DEV?
Preset	BTS
State Saved	Saved in instrument state
Range	BTS|MS
Initial S/W Revision	Prior to A.02.00

IS–95A

Sets the specific parameters for the selected measurement appropriate for industry standard IS–95A. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

J-STD–008

Sets the specific parameters for the selected measurement appropriate for industry standard J-STD–008. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

IS–97D/98D

Sets the specific parameters for the selected measurement appropriate for industry standard IS–97D/98D. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Band Class

This function is only available when you have selected the standard: IS–97D/98D. It enables you to select the band class.

Key Path	**Mode Setup, Radio Std Setup**
Scope	Meas Global
Remote Command	`[:SENSe]:RADio:STANdard:BAND:CLASs BC0|BC1` `[:SENSe]:RADio:STANdard:BAND:CLASs?`
Example	RAD:STAN:BAND:CLAS BC0 RAD:STAN:BAND:CLAS?
Preset	BC0
State Saved	Saved in instrument state
Range	0 (800 MHz Band)|1 (1900 MHz Band)
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

GSM/EDGE

Sets the specific parameters for the selected measurement appropriate for industry standard GSM/EDGE. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

3GPP W-CDMA

Sets the specific parameters for the selected measurement appropriate for industry standard 3GPP W-CDMA. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

Cdma2000 1x

Sets the specific parameters for the selected measurement appropriate for industry standard cdma2000–1x. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

NADC

Sets the specific parameters for the selected measurement appropriate for industry standard NADC. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

PDC

Sets the specific parameters for the selected measurement appropriate for industry standard PDC. For the available measurements with this radio standard, see the chart in the “Radio Standard” on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see “Device” on page 230.

Bluetooth

Sets the specific parameters for the selected measurement appropriate for industry standard Bluetooth™. For the available measurements with this radio standard, see the chart in the Radio Standard section.

Key Path	**Mode Setup, Radio Std**
Scope	Meas Global

Remote Command	[:SENSe]:RADio:STANdard:PACKet DH1|DH3|DH5 [:SENSe]:RADio:STANdard:PACKet?
Example	RAD:STAN:PACK DH1 RAD:STAN:PACK?
Notes	The packet length is DH1 -> 366 µs DH3 -> 1622 µs DH5 -> 2870 µs
Preset	DH1
State Saved	Saved in instrument state
Range	DH1|DH3|DH5
Initial S/W Revision	Prior to A.02.00

TETRA

Sets the specific parameters for the selected measurement appropriate for industry standard TETRA. For the available measurements with this radio standard, see the chart in the "Radio Standard" on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Device

Operation of this key is identical for many locations in this measurement. For details about this key, see "Device" on page 230.

W-LAN

Accesses the W-LAN radio standards key menu to enable you to select a W-LAN standard. Selecting a W-LAN standard modifies spectrum analyzer settings for the measurement activated under the Meas menu. For the available measurements with this radio standard, see the chart in the "Radio Standard" on page 229 section.

Key Path	**Mode Setup, Radio Std**
Range	802.11a|802.11b|802.11g|HiperLAN/2
Initial S/W Revision	Prior to A.02.00

DVB-T

Accesses the DVB-T key menu to enable you to select a DVB-T mask filtering standard. Selecting a DVB-T filtering standard modifies spectrum analyzer settings for the measurement activated under the Meas menu. For the available measurements with this radio standard, see the chart in the "Radio

Standard" on page 229 section.

Key Path	**Mode Setup, Radio Std**
Range	L/SECAM/NICAM|G/PAL/NICAM|I/PAL/NICAM
Initial S/W Revision	Prior to A.02.00

FCC Part 15 Subpart F

Sets the specific parameters for the selected measurement appropriate for unlicensed devices. For the available measurements with this radio standard, see the chart in the "Radio Standard" on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

S-DMB System E

Sets the specific parameters for the selected measurement appropriate for industry standard System E. For the available measurements with this radio standard, see the chart in the "Radio Standard" on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

UWB Indoor

Sets the specific parameters for the selected measurement appropriate for UWB Indoor standard. For the available measurements with this radio standard, see the chart in the "Radio Standard" on page 229 section.

Key Path	**Mode Setup, Radio Std**
Initial S/W Revision	Prior to A.02.00

Enable Non-Std Measurements

Allows you to specify whether all measurements and radio standards are enabled or not. In default, Enable All Measurements is set to No, so youcan select only the valid combination of preset available standard and measurement. Any measurement or standard that make the combination that haveno valid preset value are grayed out. When Enable Non-Std Measurements is set to Yes, all measurements and standard selections are enabled so that youcan choose any.

If you select an unavailable measurement or unavailable radio standardusing the Enable Non-Std Measurement key, the measurement results may not conform to the selected standard.

Key Path	**Mode Setup**
Scope	Meas Global

Remote Command	`[:SENSe]:RADio:STANdard:EAMeas YES|NO` `[:SENSe]:RADio:STANdard:EAMeas?`
Example	RAD:STAN:EAM YES RAD:STAN:EAM?
Preset	NO
State Saved	Saved in instrument state
Range	Yes|No
Initial S/W Revision	Prior to A.02.00

EMC Standard

Only appears with Option EMC installed and licensed.

This menu allows youto select None (no EMI standard), CISPR (CISPR 16–1–1), and MIL (MIL–461A). Each standard has a unique way of determining the couplings between detectors and RBWs, as well as its own set of available RBW's.

Note that Auto Couple will have no effect on the EMC Standard setting.

Key Path	**Mode Setup**
Scope	Meas Global
Remote Command	`[:SENSe]:EMC:STANdard[:SELect] NONE|CISPr|MIL` `[:SENSe]:EMC:STANdard[:SELect]?`
Example	:EMC:STAN CISP
Dependencies	When the **EMC Standard** changes to **CISPR** or **MIL**, the **RBW Control** key is grayed out. The **Filter Type** is then always Gaussian; the **Filter BW** is chosen as appropriate for the filter and the standard. When the EMC Standard changes to None, the Filter Type is set to Gaussian and the Filter BW is set to –3 dB. Only appears with Option EMC installed and licensed. If not, the SCPI command generates an error.
Couplings	The auto rules for detector select Peak for any trace in Auto when the EMI Standard is CISPR or MIL. Choosing a CISPR detector or CISPR presets automatically picks the CISPR Standard, however switching from a CISPR detector has no impact on EMC Standard.
State Saved	Saved in instrument state
Initial S/W Revision	A.02.00

Remote Command:	`[:SENSe]:BANDwidth|BWIDth:[:RESolution]:MODE EMI|SAN|OFF` `[:SENSe]:BANDwidth|BWIDth:[:RESolution]:MODE?`
Notes:	This command is mapped to the EMC:STANdard command with the following mappings: EMI=>CISPr, SAN =>None, and if the legacy command comes in with the OFF parameter, it sets EMC Standard to None and Res BW to Manual . The query returns “OFF” if Res BW in Manual, otherwise “EMI” if EMC Standard is CISPR or MIL, and “SAN” if EMC Standard is None
Dependencies:	Only appears with Option EMC installed and licensed. If not, the SCPI command generates an error.
Preset:	SAN
Initial S/W Revision:	A.02.00

CISPR presets

Only appears with Option EMC installed and licensed.

This key lets you easily set up the analyzer for CISPR measurements.

This topic contains the following sections:

“Band Setup” on page 237

“Sweep Points in Band E” on page 238

“Number of points in band E” on page 239

Key Path	**Mode Setup, CISPR presets**
Remote Command	`[:SENSe]:FREQuency:CISPr:BAND A|B|C|CD|D|E`
Example	FREQ:CISPR:BAND A activates the CISPR preset for Band A
Couplings	Selecting a CISPR presetsets the EMI Standard to CISPR, performs an autocouple all, and sets the Y Axis Unit to dBμV (unless dBuV is grayed out, in which case it will leave the Y Axis Unit unaffected).
Initial S/W Revision	A.02.00

Band Setup

The number of sweep points for each band is roughly calculated by the formula 2*(Stop Frequency-Start Frequency)/RBW, so that you get two points for every RBW width. This number is increased as necessary to make it an odd integer, so that you always end up with an odd number of sweep points. This is desirable so that you always have a sweep point at the Center Freq.

Band Setup	Band A	Band B	Band C	Band D	Band C&D	Band E

Start Frequency	9kHz	150kHz	30MHz	300MHz	30MHz	1GHz
Stop Frequency	150kHz	30MHz	300MHz	1GHz	1GHz	Max freq of analyzer or 18 GHz, whichever is lower
Sweep Point	1411	6635	4501	11667	16167	See below

The table above is based on the fact that the Res BW autocouples to the center frequency when in the CISPR EMC standard as follows:

Center Frequency	RBW
<150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
>30 MHz to 1 GHz	120 kHz
>1 GHz	1 MHz

Sweep Points in Band E

Note that the Res BW will be 1 MHz in band E. The number of sweep points for band E is dependent on the maximum frequency of the analyzer. The formula above gives the following values for Band E:

Number of points in band E

Option	Max Analyzer Freq (nominal)	Width of Band E	Number of Points
503 (3.0 GHz models)	3.0 Ghz	2.0 GHz	4001
503 (3.6 GHz models	3.6 Ghz	2.6 GHz	5201
507 (7 GHz models)	7.0 Ghz	6.0 GHz	12001
507 (7.5 GHz models)	7.5 Ghz	6.5 GHz	13001
508	8.4 GHz	7.4 GHz	14801
513	13.2 GHz	12.2 GHz	24401
526	26.5 GHz	17 GHz	34001

Noise Reduction

Noise Reduction accesses a menu for configuring the noise compensation of the instrument. This menu only appears in models that support Noise Reduction.

Key Path	**Mode Setup**
Initial S/W Revision	A.04.00

Noise Floor Extension

Turns on the **Noise Floor Extension** function. When this function is On, the expected noise power of the analyzer (derived from a factory calibration) is subtracted from the trace data. When **Noise Floor Extension** is On, it will usually reduce the apparent noise level by about 10 dB in low band, and 8 dB in high band (>~3.6 GHz).

Noise Floor Extension works with any RBW, VBW, detector, any setting of Average Type, any amount of trace averaging, and any signal type. It is ineffective when the trace is not smoothed (smoothing processes include narrow VBWs, trace averaging, and long sweep times with the detector set to Average or Peak). It works best with extreme amounts of smoothing. It works best with the average detector, with the Average Type set to Power.

In those cases where the cancellation is ineffective, it nonetheless has no undesirable side-effects. There is no significant speed impact to having **Noise Floor Extension** on.

The best accuracy is achieved when substantial smoothing occurs in each point before trace averaging. Thus, when using the average detector, results are better with long sweep times and fewer trace averages. When using the sample detector, the VBW filter should be set narrow with less trace averaging, instead of a wide VBW filter with more trace averaging.

See "More Information" on page 240

Remote Command	[:SENSe]:CORRection:NOISe:FLOor ON|OFF|1|0 [:SENSe]:CORRection:NOISe:FLOor?
Example	CORR:NOIS:FLO ON
Initial S/W Revision	A.04.00
Key Path	**Mode Setup, Noise Reduction**
Scope	Meas Global
Dependencies	In models that do not support Noise Floor Extension, the SCPI command will be accepted without error but will have no effect.
Preset	Unaffected by **Mode Preset**. Turned off by **Restore Mode Defaults**.
State Saved	No

More Information

The analyzer is characterized in the factory (or during a field calibration) with a model of the noise, referred to the input mixer, versus frequency in each band and path combination. Bands are 0 (low band) and 1 through 4 (high band) in a 26.5 GHz instrument, for example. Paths include normal paths, preamp paths, the electronic attenuator, etc.

In most band/path combinations, the noise can be well characterized based on just two parameters and the analyzer frequency response before compensation for frequency-dependent losses.

After the noise density at the input mixer is estimated, the effects of the input attenuator, RBW, detector, etc. are computed to get the estimated input-port-referred noise level.

In the simplest case, the measured power (signal plus analyzer noise) in each display point (bucket) is compensated by subtracting the estimated noise power, leaving just the signal power. This is the operation when the detector is Average and the Average Type is set to Power.

In other cases, operation is often not quite as good but still highly effective. With peak detection, the noise floor is estimated based on the RBW and the duration of the bucket using the same equations used in the noise marker function. The voltage of the noise is subtracted from the voltage of the observed signal-plus-noise measurement to compute the estimated signal voltage. The peak detector is one example of processing that varies with detector to give good estimates of the signal level without the analyzer noise.

For best operation, the average detector and the power scale are recommended, as already stated. Peak detection for pulsed-RF can still give excellent effectiveness. FFT analysis does not work well, and does not do NFE well, with pulsed-RF signals, so this combination is not recommended. Negative peak detection is not very useful, either. Sample detection works well, but is never better than the average detector because it doesn't smooth as well. The Normal detector is a combination of peak and negative peak behaviors, and works about as well as these.

For best operation, extreme smoothing is desirable, as already stated. Using narrow VBWs works well, but using very long bucket durations and the average detector works best. Reducing the number of trace points will make the buckets longer.

For best operation, the power scale (Average Type = Power) is optimum. When making CW measurements in the presence of noise without NFE, averaging on the decibel scale has the advantage of reducing the effect of noise. When using NFE, the NFE does an even better job than using the log scale ever could. Using NFE with the log scale is not synergistic, though; NFE with the power scale works a little better than NFE with log averaging type.

Restore Mode Defaults

Resets the state for the currently active mode by resetting the mode persistent settings to their factory default values, clearing mode data and by performing a Mode Preset

See "Restore Mode Defaults" on page 134 under "Preset" in the System Functions section, for more information.

Global Settings

Opens a menu that allows you to switch certain Meas Global parameters to a Mode Global state.

See "Global Settings" on page 227 under Mode Setup in the Common Measurement Functions section for more information.

Peak Search

Pressing the Peak Search key displays the Peak Search menu and places the selected marker on the trace point with the maximum y-axis value for that marker's trace. The Peak Search features allow you to define specific search criteria to determine which signals can be considered peaks, excluding unwanted signals from the search.

See "More Information" on page 241.

Remote Command:	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum`
Example:	CALC:MARK2:MAX performs a peak search using marker 2. CALC:MARK2:Y? queries the marker amplitude (Y-axis) value for marker 2. CALC:MARK2:X? queries the marker frequency or time (X-axis) value for marker 2. SYST:ERR? can be used to query the errors to determine if a peak is found. The error –200 will be returned after an unsuccessful search.
Notes:	Sending this command selects the subopcoded marker.
Initial S/W Revision:	Prior to A.02.00

More Information

If **Same as "Next Peak" Criteria** is selected, and either **Pk Excursion** or **Pk Threshold** are on, a signal must meet those criteria. If no valid peak is found, a message is generated. And then the marker is not moved.When **Highest Peak** is on, or both **Pk Excursion** and **Pk Threshold** are off, the marker is always placed at the point on the trace with the maximum y-axis value, even if that point is on the very edge of the trace (exception: negative frequencies and signals close to the LO are not searched at all.

Pressing Peak Search with the selected marker off causes the selected marker to be set to **Normal** at the center of the screen, then a peak search is immediately performed.

Pressing the front panel Peak Search key always does a peak search. Occasionally, you may need to get to the Peak Search menu key functions without doing a peak search. You can do this by first accessing the Peak Search menu. Then go to the other menus that you need to access. Finally, you can get back to the Peak Search key menu by using the front panel Return key and pressing it as many times as required to navigate back through the previously accessed menus until you get back to the Peak Search menu.

Next Peak

Pressing Next Peak moves the selected marker to the peak that has the next highest amplitude less than the marker's current value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, an error is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Key Path	**Peak Search**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum:NEXT`
Example	CALC:MARK2:MAX:NEXT !Selects marker 2 and moves it to the peak that is closest in amplitude to the current peak, but the next lower value.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

Next Pk Right

Pressing Next Pk Right moves the selected marker to the nearest peak right of the current marker which meets all enabled peak criteria. If there is no valid peak to the right of the current marker position, an error is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Key Path	**Peak Search**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum:RIGHt`
Example	CALC:MARK2:MAX:RIGH !Selects marker 2 and moves it to the next peak to the right of the current marker position.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

Next Pk Left

Pressing Next Pk Left moves the selected marker to the nearest peak left of the current marker which meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, an error is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Key Path	**Peak Search**
Remote Command	:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum:LEFT
Example	CALC:MARK2:MAX:LEFT selects marker 2 and moves it to the next peak to the left of the current marker position.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

Marker Delta

Performs the same function as the Delta 1-of-N selection key in the Marker menu. Basically this sets the control mode for the selected marker to Delta mode. See the Section ""Marker" on page 1571" for the complete description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

Initial S/W Revision	Prior to A.02.00
Key Path	**Peak Search or Marker**
Notes	Whenever the selected marker is in Delta mode and you are in the Peak Search menu, the Marker Delta key should be highlighted and the active function for setting its delta value turned on.

Mkr->CF

Assigns the selected marker's frequency to the Center Frequency setting. See the Section ""Marker To" on page 1613" for the description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to CF without having to access two separate menus.

Key Path	**Peak Search or Marker ->**
Dependencies	Same as specified under Marker To
Initial S/W Revision	Prior to A.02.00

Mkr->Ref Lvl

Assigns the selected marker's level to the Reference Level setting. See the Section ""Marker To" on page 1613" for the description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to RL without having to access two separate menus.

Key Path	**Peak Search or Marker ->**

Dependencies	Same as specified under Marker To
Initial S/W Revision	Prior to A.02.00

Peak Criteria

Pressing this key opens the Peak Criteria menu and allows you to adjust the Pk Threshold and Pk Excursion parameters used for peak search functions.

For a signal to be identified as a peak it must meet certain criteria. Signals in the negative frequency range and signals very close to 0 Hz are ignored. If either the peak excursion or peak threshold functions are on, then the signal must satisfy those criteria before being identified as a peak.

When peak excursion and peak threshold are both off:

Peak Search, Continuous Peak Search, and maximum part of **Pk-Pk Search** will search the trace for the point with the highest y-axis value which does not violate the LO feedthrough rules. A rising and falling slope are not required for these three peak search functions.

The remaining search functions **Next Peak, Next Pk Right**, etc. will only consider trace points which have a rising and falling slope on the left and right respectively.

Key Path	**Peak Search**
Initial S/W Revision	Prior to A.02.00

“Peak Search” Criteria

This menu lets you decide what kind of search you want to do when the Peak Search key is pressed (or the equivalent SCPI command sent).

Note that there are two “types” of peak search functions. One type is the “Peak Search” type, the other type is the “Next Peak” type. “Next Peak” searches (for example, Next Peak, Next Pk Left, Next Pk Right) are always checked using the Excursion and Threshold criteria as long as these criteria are On.The “Peak Search” type of search, simply finds the highest point on the trace. However you can change the “Peak Search” type of search so that it also uses the Excursion and Threshold criteria. This allows you to find the Maximum point on the trace that also obeys the Excursion and/or Threshold criteria.

When **Highest Peak** is selected, pressing **Peak Search** simply finds the highest peak on the marker’s trace. If **Same as “Next Peak” Criteria** is selected, then the search is also forced to consider the Excursion and Threshold found under the “**Next Peak” Criteria** menu.

Key Path	**Peak Search, Peak Criteria**
Remote Command	`:CALCulate:MARKer:PEAK:SEARch:MODE MAXimum|PARameter` `:CALCulate:MARKer:PEAK:SEARch:MODE?`
Notes	MAXimum corresponds to the **Highest Peak** setting PARameter corresponds to the **Same as “Next Peak” Criteria** setting
Preset	MAXimum

State Saved	Saved in instrument state.
Readback line	Current state
Initial S/W Revision	Prior to A.02.00

Highest Peak

When this key is selected, pressing the Peak Search key or issuing the equivalent SCPI command finds the maximum point on the trace, subject to the peak-search qualifications. This also affects the Peak Search half of Pk-Pk search and the Continuous Peak Search.

Key Path	**Peak Search, Peak Criteria, “Peak Search” Criteria**
Example	CALC:MARK:PEAK:SEAR:MODE MAX
Readback	Highest Peak
Initial S/W Revision	Prior to A.02.00

Same as “Next Peak” Criteria

When this key is selected, pressing the Peak Search key or issuing the equivalent SCPI command finds the maximum point on the trace, but subject to the Excursion and Threshold set under the Next Peak Criteria menu. The search is, of course, also subject to the peak-search qualifications. This also affects the Peak Search half of Pk-Pk search and the Continuous Peak Search.

Key Path	**Peak Search, Peak Criteria, “Peak Search” Criteria**
Example	CALC:MARK:PEAK:SEAR:MODE PAR
Readback	Use Excurs & Thr
Initial S/W Revision	Prior to A.02.00

“Next Peak” Criteria

This key opens up a menu which allows you to independently set the Peak Excursion and Peak Threshold and turn them on and off.

Key Path	**Peak Search, Peak Criteria**
Initial S/W Revision	Prior to A.02.00

Pk Excursion On/Off

Turns the peak excursion requirement on/off and sets the excursion value. The value defines the minimum amplitude variation (rise and fall) required for a signal to be identified as peak. For example, if a value of 6 dB is selected, peak search functions like the marker Next Pk Right function move only to peaks that rise and fall 6 dB or more.

When both Pk Excursion and Pk Threshold are on, a signal must rise above the Pk Threshold value by at least the **Peak Excursion** value and then fall back from its local maximum by at least the **Peak Excursion** value to be considered a peak.

NOTE	In the event that a sequence of trace points with precisely the same values represents the maximum, the leftmost point is found.

See "More Information" on page 246.

Key Path	**Peak Search, Peak Criteria, "Next Peak" Criteria**

Remote Command	`:CALCulate:MARKer:PEAK:EXCursion <rel_ampl>`
	`:CALCulate:MARKer:PEAK:EXCursion?`
	`:CALCulate:MARKer:PEAK:EXCursion:STATe OFF|ON|0|1`
	`:CALCulate:MARKer:PEAK:EXCursion:STATe?`

Example	:CALC:MARK:PEAK:EXC:STAT ON :CALC:MARK:PEAK:EXC 30 DB sets the minimum peak excursion requirement to 30 dB
Dependencies	Available only when Y axis unit is amplitude units, otherwise grayed out.
Couplings	Whenever you adjust the value of Pk Excursion (with the knob, step keys, or by completing a numeric entry), and Peak Threshold is turned ON, the Peak Threshold Line and the Peak Excursion Region are displayed.
Preset	6.0 dB ON
Preset	6.0 dB ON
State Saved	Saved in State
Min	0.0 dB
Max	100.0 dB
Initial S/W Revision	Prior to A.02.00

More Information

If two signals are very close together and the peak excursion and threshold criteria are met at the outside edges of the combined signals, this function finds the highest of these two signals as a peak (or next peak). However, if a signal appears near the edge of the screen such that the full extent of either the rising or falling edge cannot be determined, and the portion that is on screen does not meet the excursion criteria, then the signal cannot be identified as a peak.

When measuring signals near the noise floor, you can reduce the excursion value even further to make these signals recognizable. To prevent the marker from identifying noise as signals, reduce the noise floor variations to a value less than the peak-excursion value by reducing the video bandwidth or by using trace averaging.

Pk Threshold On/Off

Turns the peak threshold requirement on/off and sets the threshold value. The peak threshold value defines the minimum signal level (or min threshold) that the peak identification algorithm uses to recognize a peak.

When both Pk Excursion and Pk Threshold are on, a signal must rise above the Pk Threshold value by at least the **Peak Excursion** value and then fall back from its local maximum by at least the **Peak Excursion** value to be considered a peak.

For example, if a threshold value of –90 dBm is selected, the peak search algorithm will only consider signals with amplitude greater than the –90 dBm threshold. If a threshold value of –90 dBm is selected, and **Peak Excursion** is **On** and set to 6 dB, the peak search algorithm will only consider signals with amplitude greater than the –90 dBm threshold which rise 6 dB above the threshold and then fall back to the threshold.

Key Path	**Peak Search, Peak Criteria, "Next Peak Criteria"**

Remote Command	`:CALCulate:MARKer:PEAK:THReshold <ampl>`
	`:CALCulate:MARKer:PEAK:THReshold?`
	`:CALCulate:MARKer:PEAK:THReshold:STATe OFF|ON|0|1`
	`:CALCulate:MARKer:PEAK:THReshold:STATe?`

Example	CALC:MARK:PEAK:THR:STAT ON turns on the threshold criterion. CALC:MARK:PEAK:THR –60 dBm sets the threshold to –60 dBm.
Dependencies	When Ref Level Offset changes, Peak Threshold must change by the same amount.
Preset	–90.0 dBm ON
State Saved	Saved in instrument state.
Min	The current displayed Ref Level – 200 dB. The current displayed Ref Level is the current Ref Level, offset by the Ref Level Offset.
Max	The current displayed Ref Level. This means the current Ref Level, offset by the Ref Level Offset.
Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

Pk Threshold Line On/Off

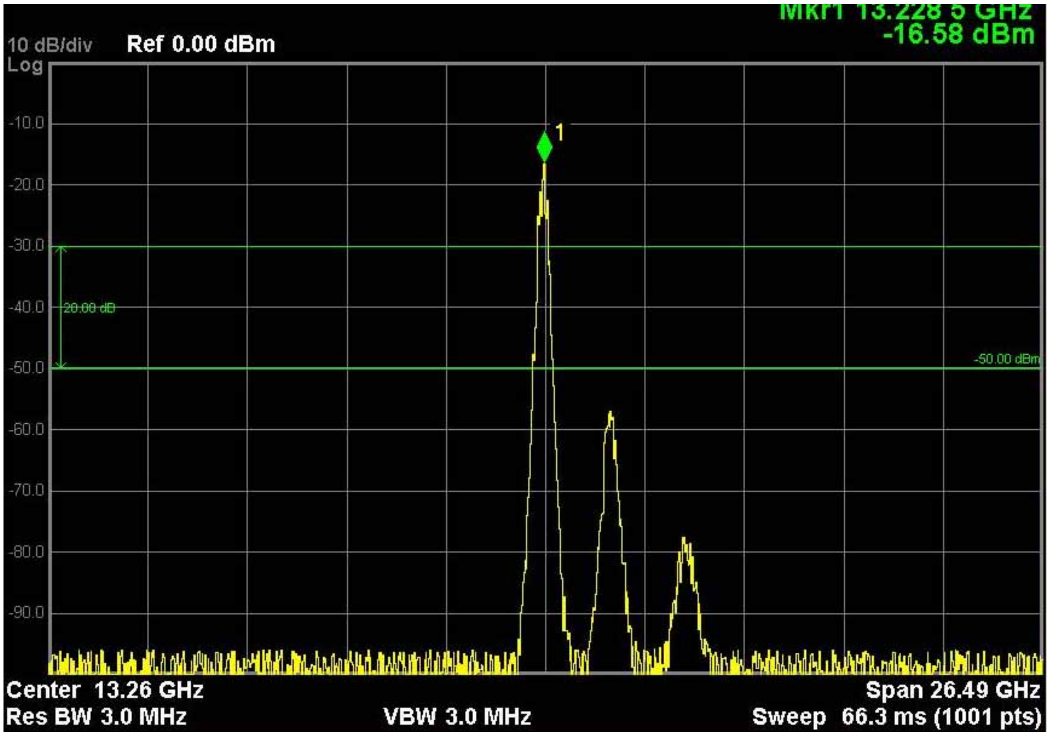
Turns the peak threshold line on or off. Preset state is off. No equivalent SCPI command.

See "More Information" on page 247.

Dependencies	If Peak Threshold is Off and the Peak Threshold line is turned on, it should turn on Peak Threshold.
Initial S/W Revision	Prior to A.02.00

More Information

The Peak Threshold line is green and has the value of the peak threshold (for example, "–20.3 dBm") written above its right side, above the line itself. If Peak Excursion is ON it shows on the left side as a region above the Peak Threshold line. As with all such lines (Display Line, Trigger Level line, etc) it is drawn on top of all traces.



This function is automatically set to ON (thus turning on the Peak Threshold line) whenever the value of Peak Threshold or Peak Excursion becomes the active function, unless Peak Threshold is OFF. It is automatically set to OFF whenever Peak Threshold is set to OFF. Manually turning it ON automatically turns on Pk Threshold.

The Peak Excursion part is on whenever the Pk Threshold part is on, unless Peak Excursion is OFF.

Peak Table

Opens the Peak Table menu.

The Peak Table provides a displayed list of up to 20 signal peaks from the selected trace. If more than one trace window is displayed, the selected trace in the selected window is used. If there are more than 20 signals which meet the peak search criteria, only the 20 highest peaks are listed.

The Peak Table is updated after each sweep. The list of peaks in the Peak Table can be ordered either by ascending frequency or by descending amplitude. In either case, the entire trace is first evaluated and the 20 highest peaks are selected for inclusion in the list. After the peaks are selected, they are then sorted and displayed according to the Peak Sort setting.

Key Path	**Peak Search**
Initial S/W Revision	Prior to A.02.00

Peak Table On/Off

Turns Peak Table on/off. When turned on, the display is split into a measurement window and a peak table display window.

Turning the Peak Table on turns the Marker Table off and vice versa.

Key Path	**Peak Search, Peak Table**
Remote Command	`:CALCulate:MARKer:PEAK:TABLe:STATe OFF|ON|0|1` `:CALCulate:MARKer:PEAK:TABLe:STATe?`
Example	CALC:MARK:PEAK:TABL:STAT ON Turns on and displays the peak table.
Dependencies	When the Peak Table turns on, if Peak Threshold is On then it becomes the active function.
Preset	OFF
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

Peak Sort

Sets the peak table sorting routine to list the peaks in order of descending amplitude or ascending frequency. The remote command can also be used to sort the peaks found using the :CALCulate:DATA:PEAKs command.

Key Path	**Peak Search, Peak Table**
Remote Command	`:CALCulate:MARKer:PEAK:SORT FREQuency|AMPLitude` `:CALCulate:MARKer:PEAK:SORT?`
Example	CALC:MARK:PEAK:SORT AMPL Sets sorting routine to list peaks in order of descending amplitude. CALC:MARK:PEAK:SORT?
Preset	AMPLitude
Preset	AMPLitude
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	:TRACe:MATH:PEAK:SORT
Backwards Compatibility SCPI	The old TRAC:MATH:PEAK:SORT command/query used in ESA is still supported for backward compatibility.
Initial S/W Revision	Prior to A.02.00

Peak Readout

Shows up to twenty signal peaks as defined by the setting:

All (ALL) - lists all the peaks defined by the peak criteria, in the current sort setting.

Above Display Line (GTDLine) - lists the peaks that are greater than the defined display line, and that meet the peak criteria. They are listed in the current sort order.

Below Display Line (LTDLine) - lists the peaks that are less than the defined display line, and that meet the peak criteria. They are listed in the current sort order.

If the peak threshold is defined and turned on, then the peaks must meet this peak criteria in addition to the display line requirements.

See "More Information" on page 250.

Key Path	**Peak Search, Peak Table**

Remote Command	`:CALCulate:MARKer:PEAK:TABLe:READout ALL|GTDLine|LTDLine`
	
	`:CALCulate:MARKer:PEAK:TABLe:READout?`

Example	CALC:MARK:PEAK:TABL:READ GTDL
Dependencies	Turning Display Line off forces Readout to ALL
Preset	All
Preset	All
State Saved	Saved in instrument state.
Readback line	1-of-N selection
Initial S/W Revision	Prior to A.02.00

More Information

If the Display Line (see the Section "View/Display") is turned on, the Peak Table can be selected to include all peaks, only those above the Display Line, or only those below the Display Line. See Figures 1–2 and 1–3 to understand what happens if both Display Line and Pk Threshold are turned on.

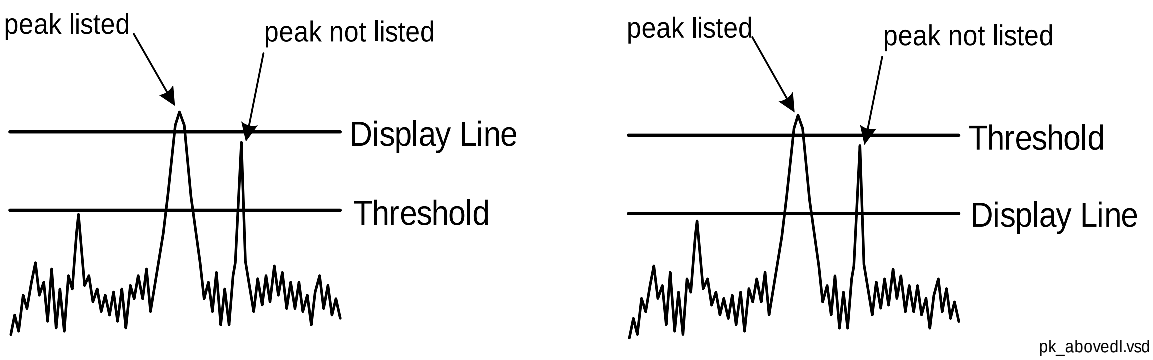


Figure 1- 2Above Display Line Peak Identification

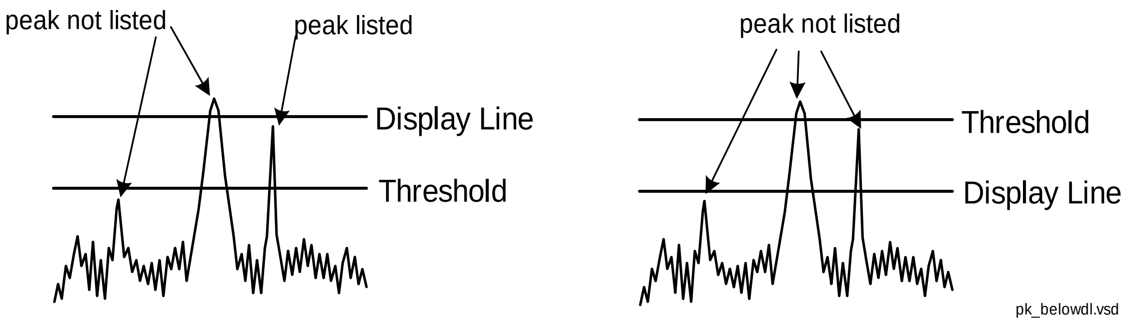


Figure 1- 3Below Display Line Peak Identification

All

Sets the peak table to display the 20 highest peaks in the order specified by the current Peak Sort setting. If the Peak Criteria are turned on, then only peaks that meet the defined Pk Excursion and Pk Threshold values will be found.

Key Path	**Peak Search, Peak Table, Peak Readout**
Example	CALC:MARK:PEAK:TABL:READ ALL
Notes	Auto return after pressed
Readback	All
Initial S/W Revision	Prior to A.02.00

Above Display Line

Sets the peak table to display only the 20 highest peaks above the display line in the order specified by the current Sort setting. If the Peak Criteria are turned on, then only peaks that meet the defined criteria will be found. If the display line is not already on, it is turned on (it has to be on or it cannot be used to exclude peaks).

Key Path	**Peak Search, Peak Table, Peak Readout**
Example	CALC:MARK:PEAK:TABL:READ GTDL
Notes	Auto return after pressed
Dependencies	When Above Display Line is selected, Display Line is turned on and becomes the active function.
Readback	Above DL
Initial S/W Revision	Prior to A.02.00

Below Display Line

Sets the peak table to display only the 20 highest peaks below the display line as defined by the peak in the order specified by the current Sort setting. If the Peak Criteria are turned on, then only peaks that meet the defined criteria will be found. If the display line is not already on, it is turned on (it has to be on or it cannot be used to exclude peaks).

Key Path	**Peak Search, Peak Table, Peak Readout**
Example	CALC:MARK:PEAK:TABL:READ LTDL
Notes	Auto return after pressed
Dependencies	When Below Display Line is selected, Display Line is turned on and becomes the active function.
Readback	Below DL
Initial S/W Revision	Prior to A.02.00

Continuous Peak Search On/Off

Turns Continuous Peak Search on or off. When Continuous Peak Search is on, a peak search is automatically performed for the selected marker after each sweep. The rules for finding the peak are exactly the same as for **Peak Search**, including the use of the peak criteria rules. If no valid peak is found, a warning is generated after each sweep.

See "More Information" on page 252.

Key Path	**Peak Search**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:CPSearch[:STATe] ON|OFF|1|0` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:CPSearch[:STATe]?`
Example	CALC:MARK:CPS ON Turns on Continuous Peak Search.
Notes	Sending this command selects the subopcoded marker
Couplings	The Continuous Peak Search key is grayed out when the selected marker is a **Fixed** marker. Also, if Continuous Peak Search is on and the selected marker becomes a fixed marker, then Continuous Peak Search is turned off and the key grayed out. **Signal Track** and **Continuous Peak Search** are mutually exclusive so if **Signal Track** is on, **Continuous Peak Search** will be grayed out and vice versa.
Preset	Mode Preset
State Saved	Saved in instrument state.
Status Bits/OPC dependencies	The Measuring bit should remain set while this command is operating and should not go false until the marker position has been updated.
Initial S/W Revision	Prior to A.02.00

More Information

When Continuous Peak Search is turned on a peak search is immediately performed and then is repeated after each sweep. If Continuous Peak Search is turned on with the selected marker off, the selected marker is set to **Normal** at the center of the screen, and then a peak search is immediately performed and subsequently repeated after each sweep.

When in Continuous Peak Search, *OPC will not return true, nor will READ or MEASure return any data, until the sweep is complete and the marker has been re-peaked. Note further that if the analyzer is in a measurement such as averaging, and Continuous Peak Search is on, the entire measurement will be allowed to complete (i.e., all the averages taken up to the average number) before the repeak takes place, and only THEN will *OPC go true and READ or MEASure return data.

Note that this function is not the “Continuous Peak” function found in some other instruments. That function was designed to track the signal; this function simply does a Peak Search after each sweep.

When Continuous Peak Search is turned on for a marker, a little “hat” is placed above the marker.

Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace. And it places that marker’s reference marker on the peak of its selected trace. This function turns on the reference marker and sets its mode to **Fixed** if it is not already on. (These markers may be on two different traces.)

The rules for finding the maximum peak are exactly the same as for **Peak Search**, including the use of the peak criteria rules. However, the minimum trace value is not required to meet any criteria other than being the minimum y-axis value in the trace.

When Pk-Pk Search is successful, a message is displayed on the message line.

If the selected marker is off, a delta type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a delta marker, then it is changed to delta which turns on the reference marker if needed, and then it performs the peak-to-peak function.

Key Path	**Peak Search**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:PTPeak`
Example	CALC:MARK:PTP CALC:MARK:Y? !queries the delta amplitude value for marker 1.
Notes	Turns on the Marker Δ active function.
Notes	Sending this command selects the subopcoded marker.
Dependencies	Pk-Pk Search is grayed out when **Coupled Markers** is on.
Couplings	The selected marker becomes a delta marker if not already in delta mode.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

Min Search

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value. If the selected marker is Off, it is turned on before the minimum search is performed.

Key Path	**Peak Search**
Remote Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MINimum`
Example	CALC:MARK:MIN selects marker 1 and moves it to the minimum amplitude value.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

Peak Data Query (RemoteCommand Only)

This command works the same way in this and many other measurements, so it is documented in the Common Measurement Functions section.. For details about this key, see "Calculate Peaks of Trace Data (Remote Command Only)" on page 164.

Recall

Most of the functions under this key work the same way in many measurements, so they are documented in the Utility Functions section. For details about this key, see “Recall” on page 139.

The Amplitude Correction Import Data function under Recall is documented here.

Amplitude Correction

This key selects the Amplitude Corrections as the data type to be imported. When pressed a second time, it brings up the Select Menu, which lets you select the Correction into which the data will be imported.

Amplitude Corrections are fully discussed in the documentation of the Input/Output key, under the Corrections softkey.

A set of preloaded Corrections files can be found in the directory

/My Documents/ EMC Limits and Ampcor.

Under this directory, the directory called Ampcor (Legacy Naming) contains a set of legacy corrections files, generally the same files that were supplied with older Agilent EMI analyzers, that use the legacy suffixes .ant, .oth, .usr, and .cbl, and the old 8-character file names. In the directory called Ampcor, the same files can be found, with the same suffixes, but with longer, more descriptive filenames.

When the Amplitude Correction is an Antenna correction and the Antenna Unit in the file is not **None**, the Y Axis Unit setting will change to match the Antenna Unit in the file.

Remote Command	`:MMEMory:LOAD:CORRection 1|2|3|4, <filename>`
Example	:MMEM:LOAD:CORR 2 "myAmpcor.csv" recalls the Amplitude Correction data from the file myAmpcor.csv in the current directory to the 2nd Amplitude Correction table, and turns on Correction 2. The default path is My Documents\amplitudeCorrections.
Initial S/W Revision	A.02.00
Key Path	**Recall, Data**
Mode	SA|EDGEGSM

Dependencies	Only the first correction array (Correction 1) supports antenna units. This means that a correction file with an Antenna Unit can only be loaded into the Corrections 1 register. Consequently only for Correction 1 does the dropdown in the Recall dialog include.ant, and if an attempt is made to load a correction file into any other Correction register which DOES contain an antenna unit, a Mass Storage error is generated. Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key will be grayed out in measurements that do not. The key will not show at all if no measurements in the Mode support it. Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type. If any of these occur during manual operation, the analyzer returns to the Import Data menu and the File Open dialog goes away. This key does not appear unless you have the proper option installed in your instrument. This command will generate an “Option not available” error unless you have the proper option installed in your instrument.
Couplings	When a correction file is loaded from mass storage, it is automatically turned on (**Correction** ON) and **Apply Corrections is** set to On. This allows the user to see its effect, thus confirming the load.
Readback	selected Correction
Backwards Compatibility SCPI	For backwards compatibility, the following parameters syntax is supported: :MMEMory:LOAD:CORRection ANTenna|CABLe|OTHer|USER, <filename> ANTenna maps to 1, CABle maps to 2, OTHer maps to 3 and USER maps to 4

Amplitude Correction 1, 2, 3, 4

These keys let you select which Correction to import the data into. Once selected, the key returns back to the Import Data menu and the selected Correction number is annotated on the key. The next step is to select the Open key in the Import Data menu.

Antenna corrections are a particular kind of Amplitude Corrections – they are distinguished in the corrections file by having the Antenna Unit set to a value other than None. Only Correction 1 supports Antenna Units.

Initial S/W Revision	A.02.00
Key Path	**Recall, Data, Amplitude Correction**
Notes	auto return
Dependencies	Only Correction 1 may be used to load a Correction that contains an Antenna Unit other than None
Preset	not part of Preset, but is reset to Correction 1 by Restore Input/Output Defaults; survives shutdown

State Saved	The current Correction number is saved in State

Restart

The Restart function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. If you are Paused, pressing Restart does a Resume.

The Restart function is accessed in several ways:

- Pressing the Restart key
- Sending the remote command INIT:IMMediate
- Sending the remote command INIT:RESTart

Remote Command:	`:INITiate[:IMMediate]`
Example:	:INIT:IMM
Couplings:	Resets average/hold count k. For the first sweep overwrites all active (update=on) traces with new current data. For application modes, it resets other parameters as required by the measurement.
Notes:	:INITiate:RESTart :INITiate:IMMediate Either of the above commands perform exactly the same function.
Key Path:	**Front-panel key**
Status Bits/OPC dependencies:	This is an Overlapped command. The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUEStionable register bit 9 (INTegrity sum) is cleared. The SWEEPING bit is set. The MEASURING bit is set.
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:INITiate:RESTart`
Example:	:INIT:REST
Couplings:	Resets average/hold count k. For the first sweep overwrites all active (update=on) traces with new current data. For application modes, it resets other parameters as required by the measurement.
Notes:	:INITiate:RESTart :INITiate:IMMediate Either of the above commands perform exactly the same function.

Status Bits/OPC dependencies:	This is an Overlapped command. The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUEStionable register bit 9 (INTegrity sum) is cleared. The SWEEPING bit is set. The MEASURING bit is set.
Initial S/W Revision:	Prior to A.02.00

The **Restart** function first aborts the current sweep/measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is in the process of aligning when **Restart** is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when Restart is pressed (for example, when averaging/holding is on). Thus when we say that **Restart** "restarts a measurement," we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement
- depending on the current settings.

With **Average/Hold Number** (in **Meas Setup** menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the analyzer stops sweeping once that sweep has completed. However, with **Average/Hold Number** >1 and at least one trace set to **Trace Average**, **Max Hold**, or **Min Hold (SA Measurement)** or **Averaging on (most other measurements)**, multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for **Average/Hold Number**. A measurement average usually applies to all traces, marker results, and numeric results; but sometimes it only applies to the numeric results.

Once the full set of sweeps has been taken, the analyzer will go to idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while **Average/Hold Number** is the active function, or sending the remote command CALC:AVER:TCON UP.

Save

Most of the functions under this key work the same way in many measurements, so they are documented in the Utility Functions section. For details about this key, see “Save” on page 155.

The Amplitude Correction Export Data function under Save is documented here.

Amplitude Correction

Pressing this key selects **Amplitude Corrections** as the data type to be exported. Pressing this key again brings up the Select Menu, which allows the user to select which **Amplitude Correction** to save.

Amplitude Corrections are fully discussed in the documentation of the Input/Output key, under the Corrections softkey.

Remote Command:	`:MMEMory:STORe:CORRection 1|2|3|4, <filename>`
Example:	:MMEM:STOR:CORR 2 "myAmpcor.csv" saves Correction 2 to the file myAmpcor.csv on the current path. The default path is My Documents\amplitudeCorrections.
Notes:	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Key Path:	**Save, Data**
Readback:	1 | 2 | 3 | 4
Dependencies:	Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key will be grayed out in measurements that do not. The key will not show at all if no measurements in the Mode support it. This key will not appear unless you have the proper option installed in your instrument.
Backwards Compatibility SCPI:	For backwards compatibility only, the following parameters syntax is supported: :MMEMory:STORe:CORRection ANTenna|CABLe|OTHer|USER, <filename> ANTenna maps to 1, CABle maps to 2, OTHer maps to 3 and USER maps to 4
Initial S/W Revision:	A.02.00

Correction Data File

A Corrections Data File contains a copy of one of the analyzer correction tables. Corrections provide a way to adjust the trace display for predetermined gain curves (such as for cable loss).

The first five lines are system-required header lines, and must be in the correct order.

Amplitude CorrectionData file type name
“Correction Factors for 11966E”File Description
“Class B Radiated”Comment
A.01.00.R0001,N9020AInstrument Version, Model Number
P13 EA3 UK6,01Option List, File Format Version

Corrections files may include Antenna amplitude units. This amplitude unit in the Antenna Unit field is a conversion factor that is used to adjust the Y Axis Units of the current mode, if the mode supports Antenna Units. For more details on antenna correction data, refer to the Input/Output chapter, Corrections section.

The metadata required to properly import the correction data is:

Frequency Unit for the x axis data

Antenna Unit for the y axis data (not required)

Frequency Interpolation algorithm – either Logarithmic or Linear

The data follows as comma separated X, Y pairs; one pair per line. The keyword “DATA” precedes the data.

For example, suppose you have an Antenna to correct for on an E4445A version A.01.00 R0011 and the correction data is:

0 dB at 200 MHz

17 dB at 210 MHz

14.8 dB at 225 MHz

Then the file will look like:

Amplitude Correction

"Correction Factors for 11966E"

"Class B Radiated"

A.01.00 R0011,N9020A

P13 EA3 UK6,01

Frequency Unit,MHz

Antenna Unit,dBuV/m

Frequency Interpolation,Linear

DATA

200.000000,0.00

210.000000,17.00

225.000000,14.80

The choices for the 1 of N fields in the metadata are as follows:

Frequency Unit: Hz, kHz, MHz, GHz

Antenna Unit: dBuv/m, dBuA/m, dBG, dBpT, None

Frequency Interpolation: Logarithmic, Linear

Amplitude Correction 1, 2, 3, 4

These keys let you pick which Correction to save. Once selected, the key returns back to the Export Data menu and the selected Correction number is annotated on the key.

The next step in the Save process is to select the Save As key in the Export Data menu.

Key Path	**Save, Data, Amplitude Correction**
Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown.
Readback	1
Initial S/W Revision	A.02.00

Single (Single Measurement/Sweep)

Sets the analyzer for Single measurement operation. The single/continuous state is Meas Global, so the setting will affect all the measurements. If you are Paused, pressing **Single** does a Resume.

Example:	:INIT:CONT OFF
Notes:	See **Cont** key description.
Key Path:	**Front-panel key**
Initial S/W Revision:	Prior to A.02.00

Source

This mode does not have any Source control functionality.

Key Path	Front-panel key
Initial S/W Revision	Prior to A.02.00

Sweep/Control

Accesses a menu that enables you to configure the Sweep and Control functions of the analyzer, such as Sweep Time and Gating.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Sweep Time

Controls the time the analyzer takes to sweep the current frequency span when the Sweep Type is Swept, and displays the equivalent Sweep Time when the Sweep Type is FFT.

When Sweep Time is in Auto, the analyzer computes a sweep time which will give accurate measurements based on other settings of the analyzer, such as RBW and VBW.

NOTE The Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the manual sweep time entered is faster than the sweep time computed by the analyzer's sweep time equations, that is, the Auto Sweep Time. The analyzer's computed sweep time will give accurate measurements; if you sweep faster than this your measurements may be inaccurate. A Meas Uncal condition may be corrected by returning the Sweep Time to Auto; by entering a longer Sweep Time; or by choosing a wider RBW and/or VBW

On occasion other factors such as the YTF sweep rate (in high band) or the LO's capability (in low band) can cause a Meas Uncal condition. The most reliable way to correct it is to return the Sweep Time to Auto.

When Sweep Type is FFT, you cannot control the sweep time, it is simply reported by the analyzer to give you an idea of how long the measurement is taking.

Note that although some overhead time is required by the analyzer to complete a sweep cycle, the sweep time reported when Sweep Type is Swept does not include the overhead time, just the time to sweep the LO over the current Span. When Sweep Type is FFT, however, the reported Sweep Time takes into account both the data acquisition time and the processing time, in order to report an equivalent Sweep Time for a meaningful comparison to the Swept case.

Because there is no “Auto Sweep Time” when in zero span, the Auto/Man line on this key disappears when in Zero Span. The Auto/Man line also disappears when in an FFT sweep. In this case the key is grayed out as shown below.

Key Path	**Sweep/Control**

Remote Command	`[:SENSe]:SWEep:TIME <time>`
	`[:SENSe]:SWEep:TIME?`
	`[:SENSe]:SWEep:TIME:AUTO OFF|ON|0|1`
	`[:SENSe]:SWEep:TIME:AUTO?`

Example	SWE:TIME 500 ms SWE:TIME:AUTO OFF
Notes	The values shown in this table reflect the “swept spans” conditions which are the default settings after a preset. See “Couplings” for values in the zero span domain.
Dependencies	The third line of the softkey (Auto/Man) disappears in Zero Span. The SCPI command SWEep:TIME:AUTO ON if sent in Zero Span generates an error message. Softkey grayed out and third line of the softkey (Auto/Man) disappears in FFT sweeps. Pressing the key or sending the SCPI for sweep time while the instrument is in FFT sweep generates a –221, “Settings Conflict;” error. The SCPI command :SWEep:TIME:AUTO ON if sent in FFT sweeps generates an error. Grayed out while in Gate View, to avoid confusing those who want to set Gate View Sweep Time. Key is grayed out in Measurements that do not support swept mode. Key is blanked in Modes that do not support swept mode. Set to Auto when Auto Couple is pressed or sent remotely

Couplings	Sweep Time is coupled primarily to Span and RBW. Center Frequency, VBW, and the number of sweep points also can have an effect. So changing these parameters may change the sweep time. The Sweep Time used upon entry to Zero Span is the same as the Sweep Time that was in effect before entering Zero Span. The Sweep Time can be changed while in Zero Span. Upon leaving Zero Span, the Auto/Man state of Sweep Time that existed before entering Zero Span is restored. If Sweep Time was in Auto before entering Zero Span, or if it is set to Auto while in zero span (which can happen via remote command or if **Auto Couple** is pressed) it returns to Auto and recouples when returning to non-zero spans. If Sweep Time was in Man before entering Zero Span, it returns to Man when returning to non-zero spans, and any changes to Sweep Time that were made while in Zero Span are retained in the non-zero span (except where constrained by minimum limits, which are different in and out of zero span).
Preset	The preset Sweep Time value is hardware dependent since Sweep Time presets to “Auto”.
State Saved	Saved in instrument state
Min	in zero span: 1 µs in swept spans: 1 ms
Max	in zero span: 6000 s in swept spans: 4000 s
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUEStionable:INTegrity:UNCalibrated register
Initial S/W Revision	Prior to A.02.00

Sweep Setup

Lets you set the sweep functions that control features such as sweep type and time.

Key Path	**Sweep/Control**
Dependencies	The whole Sweep Setup menu is grayed out in Zero Span, however, the settings in the menus under Sweep Setup can be changed remotely with no error indication. Grayed out in measurements that do not support swept mode. Blanked in modes that do not support swept mode
Initial S/W Revision	Prior to A.02.00

Sweep Time Rules

Allows the choice of three distinct sets of sweep time rules. These are the rules that are used to set the sweep time when **Sweep Time** is in **Auto mode.** Note that these rules only apply when in the Swept **Sweep Type** (either manually or automatically chosen) and not when in FFT sweeps.

See "More Information" on page 266.

Key Path	**Sweep/Control, Sweep Setup**
Remote Command	`[:SENSe]:SWEep:TIME:AUTO:RULes NORMal|ACCuracy|SRESponse` `[:SENSe]:SWEep:TIME:AUTO:RULes?`
Example	SWE:TIME:AUTO:RUL ACC
Dependencies	In Zero Span, this key is irrelevant and cannot be accessed (because the whole Sweep Setup menu is grayed out in Zero Span), however its settings can be changed remotely with no error indication. Grayed out in FFT sweeps. Pressing the key while the instrument is in FFT sweep generates an advisory message. The SCPI is acted upon if sent, but has no effect other than to change the readout on the key, as long as the analyzer is in an FFT sweep.
Couplings	Set to Auto on Auto Couple
Preset	AUTO
State Saved	Saved in instrument state
Backwards Compatibility SCPI	The old Auto Sweep Time command was the same [:SENSe]:SWEep:TIME:AUTO:RULes NORMal|ACCuracy so it still works although it now has a third parameter (SRESponse). The old Sweep Coupling command was [:SENSe]:SWEep:TIME:AUTO:MODE SRESponse|SANalyzer and it is aliased as follows: :SWEep:TIME:AUTO:MODE SRESponse is aliased to :SWEep:TIME:AUTO:RULes SRESponse, and :SWEep:TIME:AUTO:MODE SANalyzer is aliased to :SWEep:TIME:AUTO:RULes NORMal The query :SWEep:TIME:AUTO:MODE? is aliased to :SWEep:TIME:RULes? So it will fail to match for SANalyzer
Initial S/W Revision	Prior to A.02.00

More Information

The first set of rules is called **SA – Normal**. **Sweep Time Rules** is set to **SA-Normal** on a **Preset** or **Auto Couple**. These rules give optimal sweep times at a lossof accuracy. Note that this means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Setting **Sweep Time Rules** to **SA-Accuracy** will result in slower sweep times than **SA-Normal**, usually about three times as long, but with better amplitude accuracy for CW signals. The instrument absolute amplitude accuracy specifications only apply when **Sweep Time** is set to **Auto**, and **Sweep Time Rules** are set to **SA-Accuracy**. Additional amplitude errors which occur when **Sweep Time Rules** are set to **SA-Normal** are usually well under 0.1 dB, though this is not guaranteed. Because of the faster sweep times and still low errors, **SA-Normal** is the preferred setting of **Sweep Time Rules**.

The third set of sweep time rules is called **Stimulus/Response** and is automatically selected when an integrated source is turned on, such as a Tracking Generator or a synchronized external source. The sweep times for this set of rules are usually much faster for swept-response measurements. Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system's frequency span is less than 20 times the bandwidth of the device under test. You can select these rules manually (even if not making Stimulus-Response measurements) to get faster sweeps without the "Meas Uncal" warning, but you are then not protected from the over-sweep condition and may end up with uncalibrated results. However, it is commonplace in measuring non-CW signals such as noise to be able to get excellent measurement accuracy at sweep rates higher than those required for CW signal accuracy, so this is a valid measurement technique.

Auto

Sets the analyzer to automatically choose the Sweep Time Rules for the measurement.

Key Path	**Sweep/Control, Sweep Setup, Sweep Time Rules**
Remote Command	`[:SENSe]:SWEep:TIME:AUTO:RULes:AUTO[:STATe] ON|OFF|1|0` `[:SENSe]:SWEep:TIME:AUTO:RULes:AUTO[:STATe]?`
Example	:SWE:TIME:AUTO:RUL:AUTO ON
Couplings	Set on Preset or Auto Couple
Preset	ON
Initial S/W Revision	Prior to A.02.00

SA - Normal

Chooses Sweep Time Auto Rules for optimal speed and generally sufficient accuracy.

Key Path	**Sweep/Control, Sweep Setup, Sweep Time Rules**
Example	:SWE:TIME:AUTO:RUL NORM
Couplings	Automatically selected unless Source is on If directly selected, sets AUTO to Off
Readback	SA - Normal
Initial S/W Revision	Prior to A.02.00

SA - Accuracy

Chooses Sweep Time Auto Rules for specified absolute amplitude accuracy.

Key Path	**Sweep/Control, Sweep Setup, Sweep Time Rules**
Example	:SWE:TIME:AUTO:RUL ACC

Dependencies	Do not allow sweep time to fall below 20 ms when in SA - Accuracy
Couplings	If directly selected, sets AUTO to Off
Readback	SA - Accuracy
Initial S/W Revision	Prior to A.02.00

Stimulus/Response

Chooses Sweep Time Auto Rules for use with a source.

Key Path	**Sweep/Control, Sweep Setup, Sweep Time Rules**
Example	:SWE:TIME:AUTO:RUL SRES
Couplings	Automatically selected when Source is on If directly selected sets AUTO to Off
Readback	SR
Initial S/W Revision	Prior to A.02.00

Sweep Type

Chooses between the FFT and Sweep types of sweep.

Sweep Type refers to whether or not the instrument is in Swept or FFT analysis. When in Auto, the selection of sweep type is governed by two different sets of rules, depending on whether you want to optimize for dynamic range or for speed.

FFT "sweeps" should not be used when making EMI measurements; therefore, when a CISPR detector (Quasi Peak, EMI Average, RMS Average) is selected for any active trace (one for which Update is on), the FFT key in the Sweep Type menu is grayed out, and the Auto Rules only choose Swept. If Sweep Type is manually selected to be FFT, the CISPR detectors are all grayed out.

FFT sweeps will never be auto-selected when Screen Video, Log Video or Linear Video are the selected Analog Output.

Key Path	**Sweep/Control, Sweep Setup**
Remote Command	`[:SENSe]:SWEep:TYPE FFT|SWEep` `[:SENSe]:SWEep:TYPE?`
Notes	For a backward compatibility, the following remote parameters AUTO SWP will be supported by the [:SENSe]:SWEep:TYPE command.

Dependencies	In Zero Span, this key is irrelevant and cannot be accessed (because the whole Sweep Setup menu is grayed out in Zero Span), however its settings can be changed remotely with no error indication. When Gate is on, Gate Method selection affects Sweep Type: Method FFT&Sweep menu FFT Swept grayed out and rules choose FFT Video FFT grayed out and rules choose Swept LO FFT grayed out and rules choose Swept
Preset	AUTO
Backwards Compatibility SCPI	[:SENSe]:SWEep:TYPE AUTO !sets sweep type Auto to On [:SENSe]:SWEep:TYPE SWP !selects sweep type Swept
Initial S/W Revision	Prior to A.02.00

Auto

When in Auto, the selection of sweep type is governed by two different sets of rules, depending on whether you want to optimize for dynamic range or for speed. These rules are chosen under the **Sweep Type Rules** key.

Key Path	**Sweep/Control, Sweep Setup, Sweep Type**
Remote Command	`[:SENSe]:SWEep:TYPE:AUTO OFF|ON|0|1` `[:SENSe]:SWEep:TYPE:AUTO?`
Example	:SWE:TYPE:AUTO ON
Couplings	Pressing Auto Couple always sets Sweep Type to Auto.
Preset	ON
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Swept

Manually selects swept analysis, so it cannot change automatically to FFT.

Key Path	**Sweep/Control, Sweep Setup, Sweep Type**
Example	SWE:TYPE SWE
Dependencies	Grayed out while in Gated FFT (meaning Gate is ON and Gate Method is FFT). If this key is selected, the gate method Gated FFT is grayed out.
Couplings	This selection is chosen automatically if any of the CISPR detectors is chosen for any active trace, in which case the FFT Sweep Type selection is also grayed out.

State Saved	Saved in instrument state
Readback	Swept
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

FFT

Manually selects FFT analysis, so it cannot change automatically to Swept.

Key Path	**Sweep/Control, Sweep Setup, Sweep Type**
Example	SWE:TYPE FFT
Dependencies	When a CISPR detector (Quasi Peak, EMI Average, RMS Average) is selected for any active trace, the FFT key is grayed out. If Sweep Type is manually selected to be FFT, the CISPR detectors are all grayed out. Grayed out while in Gated LO (meaning Gate is ON and Gate Method is LO). Grayed out while in Gated Video (meaning Gate is ON and Gate Method is Video). If this key is selected, all of the gate Methods except Gated FFT are grayed out. If Manual FFT is selected, the Signal ID key is grayed out. When Signal ID is on, Manual FFT is grayed out.
Couplings	For both the dynamic range case and the speed case, swept is chosen whenever any form of Signal ID is on.
State Saved	Saved in instrument state
Readback	FFT
Initial S/W Revision	Prior to A.02.00

Sweep Type Rules

Selects which set of rules will be used for automatically choosing the Sweep Type when Sweep Type is in Auto.

Key Path	**Sweep/Control, Sweep Setup**
Remote Command	`[:SENSe]:SWEep:TYPE:AUTO:RULes SPEed|DRANge` `[:SENSe]:SWEep:TYPE:AUTO:RULes?`
Dependencies	In Zero Span, this key is irrelevant and cannot be accessed (because the whole Sweep Setup menu is grayed out in Zero Span), however its settings can be changed remotely with no error indication.
Preset	DRANge

State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Auto

This selection is automatically chosen when Auto Couple is pressed. When in Auto, the Sweep Type Rules are set to Best Dynamic Range. It seems like a very simple Auto function but the use of this construct allows a consistent statement about what the Auto Couple key does.

Key Path	**Sweep/Control, Sweep Setup, Sweep Type Rules**
Remote Command	`[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe] OFF|ON|0|1` `[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe]?`
Example	:SWE:TYPE:AUTO:RUL:AUTO ON
Couplings	Pressing Auto Couple always sets Sweep Type Rules to Auto.
Preset	ON
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Best Dynamic Range

This selection tells the analyzer to choose between swept and FFT analysis with the primary goal of optimizing dynamic range. If the dynamic range is very close between swept and FFT, then it chooses the faster one. This auto selection also depends on RBW Type.

In determining the Swept or FFT setting, the auto rules use the following approach:

If the RBW Filter Type is Gaussian use the RBW for the Normal Filter BW and if that RBW > 210 Hz, use swept; for RBW <= 210 Hz, use FFT

If the RBW Filter Type is Flat Top, use the same algorithm but use 420 Hz instead of 210 Hz for the transition point between Swept and FFT

If any of the CISPR detectors is chosen for any active trace, always use Swept.

Key Path	**Sweep/Control, Sweep Setup, Sweep Type Rules**
Example	SWE:TYPE:AUTO:RUL DRAN sets the auto rules to dynamic range.
Couplings	Directly selecting this setting sets AUTO to OFF.
Readback	Dynamic Range
Initial S/W Revision	Prior to A.02.00

Best Speed

This selection tells the analyzer to choose between FFT or swept analysis based on the fastest analyzer speed.

Key Path	**Sweep/Control, Sweep Setup, Sweep Type Rules**

Example	SWE:TYPE:AUTO:RUL SPE sets the rules for the auto mode to speed
Couplings	Directly selecting this setting sets AUTO to OFF.
Readback	Speed.
Initial S/W Revision	Prior to A.02.00

FFT Width

This menudisplays and controls the width of the FFT's performed while in FFT mode.   The "FFT width" is the range of frequencies being looked at by the FFT, sometimes referred to as the "chunk width" -- it is not the resolution bandwidth used when performing the FFT.

It is important to understand that this function does not directly set the FFT width, it sets the limit on the FFT Width. The actual FFT width used is determined by several other factors including the Span you have set. Usually the instrument picks the optimal FFT Width based on the current setup; but on occasion you may wish to limit the FFT Width to be narrower than that which the instrument would have set.

NOTE this function does not allow you to widen the FFT Width beyond that which the instrument might have set; it only allows you to narrow it. You might do this to improve the dynamic range of the measurement or eliminate nearby spurs from your measurement.

Note that the **FFT Width** setting will have no effect unless in an FFT sweep.

See "More Information" on page 273

Remote Command	`[:SENSe]:SWEep:FFT:WIDTh <real>` `[:SENSe]:SWEep:FFT:WIDTh?`
Example	SWE:FFT:WIDT 167 kHz sets this function to "<167.4 kHz"
Initial S/W Revision	Prior to A.02.00
Key Path	**Sweep/Control, Sweep Setup**
Notes	The parameter is in units of frequency. For values sent from SCPI, the analyzer chooses the smallest value that is at least as great as the requested value. Examples: Parameter 3.99 kHz is sent over SCPI. Analyzer chooses 4.01 kHz Parameter 4.02 kHz is sent over SCPI. Analyzer chooses 28.81 kHz Parameter 8 MHz is sent over SCPI. Analyzer chooses 10 MHz

Dependencies	In some models, the analog prefilters are not provided. In these models the **FFT Width** function is always in **Auto**. The FFT Width key is blanked in these models, and the SCPI commands are accepted without error but have no effect. In Zero Span, this key is irrelevant and cannot be accessed (because the whole Sweep Setup menu is grayed out in Zero Span). However, its settings can be changed remotely with no error indication.
Couplings	The FFT Width affects the **ADC Dither** function (see Meas Setup key) and the point at which the instrument switches from Swept to FFT acquisition.
Preset	The Preset is Auto, but Preset will also pick Best Dynamic Range and hence this function will be set to ~Maximum
State Saved	Saved in instrument state
Min	4.01 kHz
Max	The maximum available FFT width is dependent on the IF Bandwidth option. For Option B10 the maximimum available width is 10 MHz; for Option B25 it is 25 MHz, and for Option B40 it is 40 MHz.
Backwards Compatibility SCPI	[:SENSe]:SWEep:FFT:SPAN:RATio <integer> [:SENSe]:SWEep:FFT:SPAN:RATio? The behavior of the analyzer when it receives this command is to compute the "intended segment width" by dividing the Span by the FFTs/Span parameter, then converting this intended width to an actual width by using the largest available FFT Width that is still less than the intended segment width. The "Span" used in this computation is whatever the Span is currently set to, whether a sweep has been taken at that Span or not.
Modified at S/W Revision	A.04.00

Key Path	**Sweep/Control, Sweep Setup**

Remote Command	`[:SENSe]:SWEep:FFT:WIDTh:AUTO OFF|ON|0|1`
	
	`[:SENSe]:SWEep:FFT:WIDTh:AUTO?`

Example	:SWE:FFT:WIDT:AUTO ON
Couplings	Pressing Auto Couple always sets FFT Width to Auto.
Preset	ON
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

More Information

An FFT measurement can only be performed over a limited span known as the "FFT segment". Several segments may need to be combined to measure the entire span. For advanced FFT control in the X-Series, you have direct control over the segment width using the **FFT Width** control. Generally, in automatic operation, the X-Series sets the segment width to be as wide as possible, as this results in the fastest measurements.

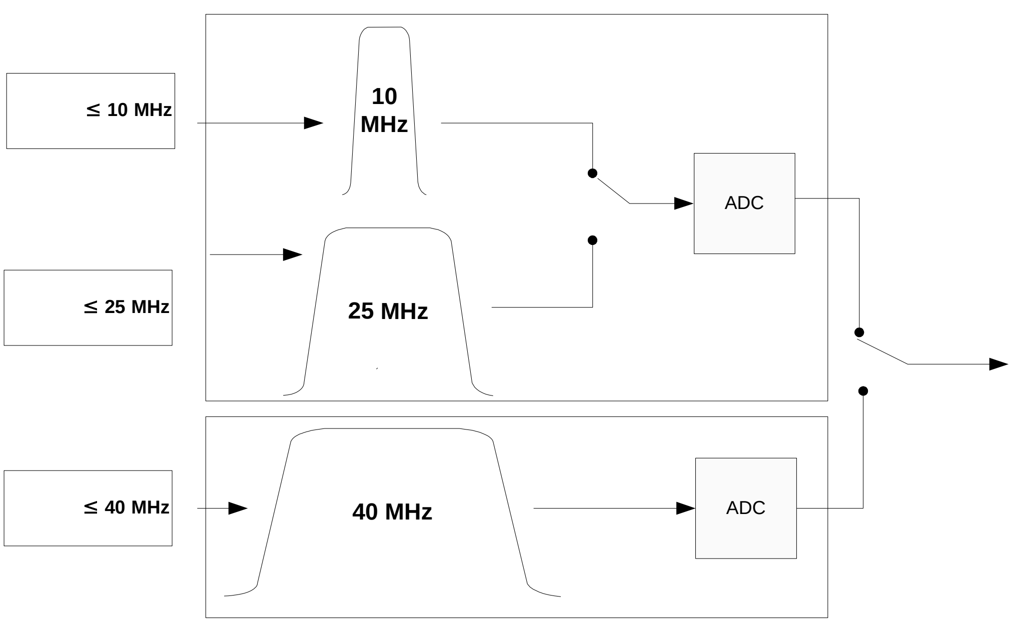
However, in order to increase dynamic range, most X-series models provide a set of analog prefilters that precede the ADC. Unlike swept measurements, which pass the signal through a bandpass before the ADC, FFT measurements present the full signal bandwidth to the ADC, making them more susceptible to overload, and requiring a lower signal level. The prefilters act to alleviate this phenomenon - they allow the signal level at the ADC to be higher while still avoiding an ADC overload, by eliminating signal power outside the bandwidth of interest, which in turn improves dynamic range.

Although narrowing the segment width can allow higher dynamic ranges some cases, this comes at the expense of losing some of the speed advantages of the FFT, because narrower segments require more acquisitions and proportionately more processing overhead.

However, the advantages of narrow segments can be significant. For example, in pulsed-RF measurements such as radar, it is often possible to make high dynamic range measurements with signal levels approaching the compression threshold of the analyzer in swept spans (well over 0 dBm), while resolving the spectral components to levels below the maximum IF drive level (about –8 dBm at the input mixer). But FFT processing experiences overloads at the maximum IF drive level even if the RBW is small enough that no single spectral component exceeds the maximum IF drive level. If you reduce the width of an FFT, an analog filter is placed before the ADC that is about 1.3 times as wide as the FFT segment width. This spreads out the pulsed RF in time and reduces the maximum signal level seen by the ADC. Therefore, the input attenuation can be reduced and the dynamic range increased without overloading the ADC.

Further improvement in dynamic range is possible by changing the **FFT IF Gain** (in the **Meas Setup** menu of many measurements). If the segments are reduced in width, **FFT IF Gain** can be set to High, improving dynamic range.

Depending on what IF Bandwidth option you have ordered, there can be up to three different IF paths available in FFT sweeps, as seen in the diagram below:



The 10 MHz path is always used for Swept sweeps. It is always used for FFT sweeps as well, unless the user specifies ~25 MHz in which case the 25 MHz path will be used for FFT sweeps, or ~40 MHz, in

which case the 40 MHz path will be used for FFT sweeps. Note that, although each of these keys picks the specified path, the analyzer may choose an FFT width less than the full IF width, in order to optimize speed, trading off acquisition time versus processing time.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When Paused, the label on the key changes to Resume. Pressing Resume un-pauses the measurement. When you are Paused, pressing **Restart**, **Single** or **Cont** does a Resume.

Key Path	**Sweep/Control**
Remote Command	`:INITiate:PAUSe`
Dependencies	Grayed out in Measurements that do not support Pausing. Blanked in Modes that do not support Pausing.
Initial S/W Revision	Prior to A.02.00

Key Path	**Sweep/Control**
Remote Command	`:INITiate:RESume`
Dependencies	Grayed out in Measurements that do not support Pausing. Blanked in Modes that do not support Pausing.
Initial S/W Revision	Prior to A.02.00

Gate

Accesses a menu that enables you to control the gating function. The Gate functionality is used to view signals best viewed by qualifying them with other events.

Gate setup parameters are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

NOTE Sweep Time autocoupling rules and annotation are changed by Gate being on.

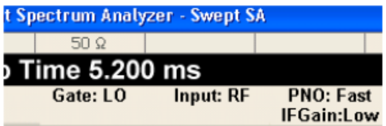
Key Path	**Sweep/Control**
Scope	Meas Global
Readback	The state and method of Gate, as [Off, LO] or [On, Video]. Note that for measurements that only support gated LO, the method is nonetheless read back, but always as LO.
Initial S/W Revision	Prior to A.02.00

Gate On/Off

Turns the gate function on and off.

When the Gate Function is on, the selected Gate Method is used along with the gate settings and the signal at the gate source to control the sweep and video system with the gate signal. Not all measurements allow every type of Gate Methods.

When Gate is on, the annunciation in the measurement bar reflects that it is on and what method is used, as seen in the following "Gate: LO" annunciator graphic.



Key Path	**Sweep/Control, Gate**
Remote Command	`[:SENSe]:SWEep:EGATe[:STATe] OFF|ON|0|1` `[:SENSe]:SWEep:EGATe[:STATe]?`
Example	SWE:EGAT ON SWE:EGAT?
Dependencies	The function is unavailable (grayed out) and Off when: Gate Method is LO or Video and FFT Sweep Type is manually selected. Gate Method is FFT and Swept Sweep Type is manually selected. Marker Count is ON.
Couplings	When Meas Method is RBW or FAST, this function is unavailable and the key is grayed out. Whenever Gate is on, Meas Method, RBW or FAST is unavailable and keys for those are grayed out. When Gate is on, Offset Res BW and Offset Video BW are ignored (if you set these values) and the measurement works as if all Offset Res BW and all Offset Video BW are coupled with the Res BW and the Video BW under the BW menu. When Gate is on, the Offset BW key in the Offset/Limit menu is grayed out.
Preset	Off
State Saved	Saved in instrument state
Range	On|Off
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE[:STATe]
Initial S/W Revision	Prior to A.02.00

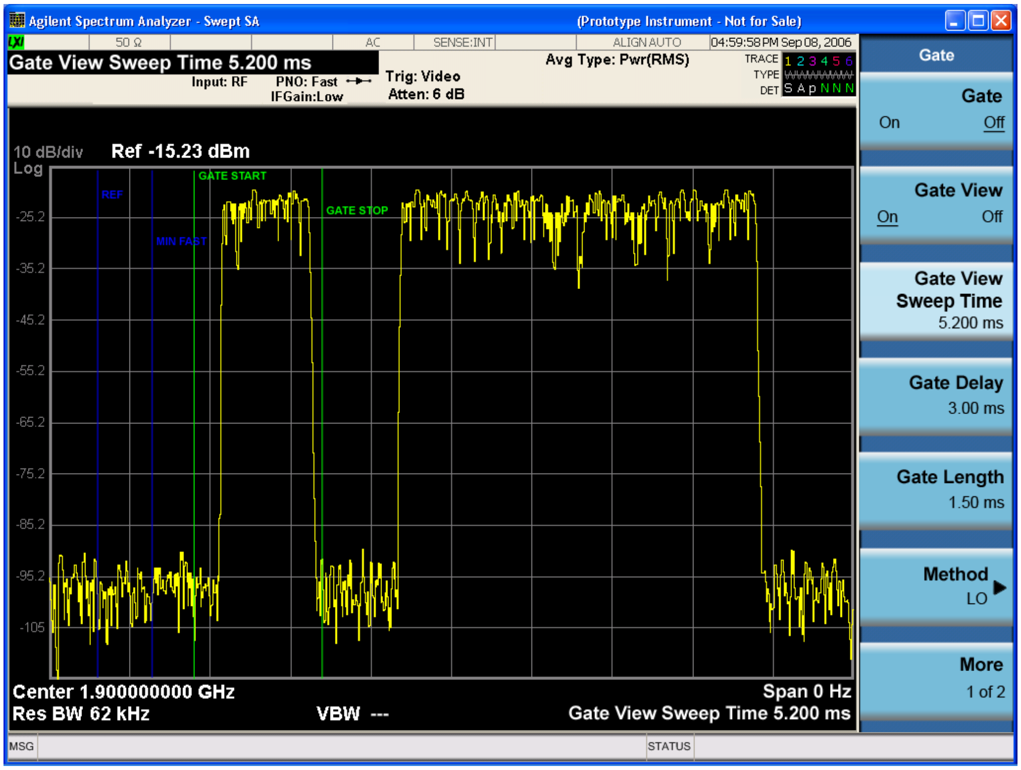
Gate View On/Off

Turning on Gate View in the Swept SA measurement provides a single-window gate view display.

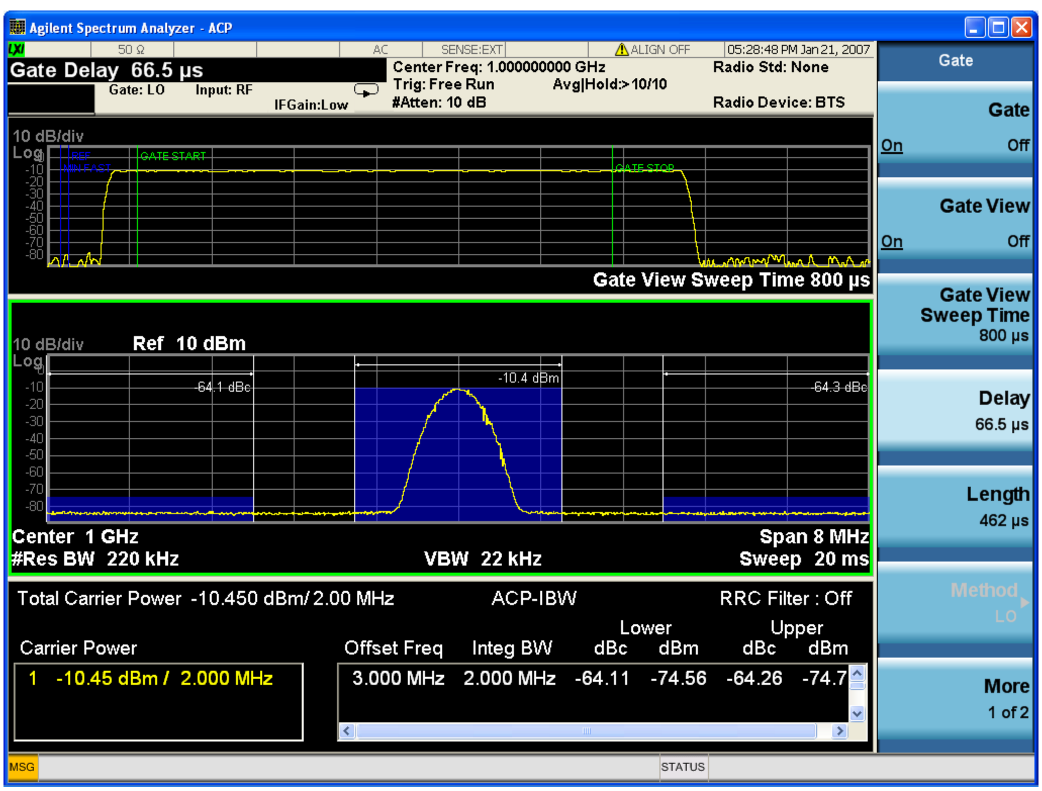
Turning on Gate View in other measurements shows the split-screen Gate View. In these measurements, when the Gate View is on, the regular view of the current measurement traces and results are reduced vertically to about 70% of the regular height. The Zero Span window, showing the positions of the Gate, is shown between the Measurement Bar and the reduced measurement window. By reducing the height of the measurement window, some of the annotation on the Data Display may not fit and is not shown.

Key Path	**Sweep/Control, Gate**
Remote Command	`[:SENSe]:SWEep:EGATe:VIEW ON|OFF|1|0` `[:SENSe]:SWEep:EGATe:VIEW?`
Example	SWE:EGAT:VIEW ON turns on the gate view.
Dependencies	In the Swept SA measurement: In Gate View, the regular Sweep Time key is grayed out . In the other measurements: When you turn Gate View on, the lower window takes on the current state of the instrument. Upon leaving Gate View, the instrument takes on the state of the lower window. When you turn Gate View on, the upper window Sweep Time is set to the gate view sweep time.
Couplings	These couplings apply to the Swept SA measurement: • When Gate View is turned on, the instrument is set to Zero Span. • Gate View automatically turns off whenever a Span other than Zero is selected. • Gate View automatically turns off ifyou pressthe Last Span key while in Gate View, and the instrument returns to the Span it was in before entering Gate View (even if that is Zero Span). When Gate View is turned on, the sweep time used is the gate view sweep time. This is set according to the rules in “Gate View Sweep Time” on page 279. • When Gate View is turned off, Sweep Time is set to the normal Swept SA measurement sweep time. • If Gate View is on and Gate is off, then turning on Gate turns off Gate View.
Preset	OFF
State Saved	Saved in instrument state
Range	On|Off
Initial S/W Revision	Prior to A.02.00

A sample of the Gate View screen in the Swept SA measurement is shown in the following graphic :



A sample of the Gate View screen in other measurements is shown in the following graphic . This example is for the ACP measurement:



Turning Gate View off returns the analyzer to the Normal measurement view.

In the Swept SA, the normal measurement view is the single-window Swept SA view. When returning to this view, the Swept SA measurement returns to the Span it was in before entering **Gate View** (even if that is Zero Span).

The **Gate View** window is triggered from the Gate Source, with zero trigger delay. Also, when updating the **Gate View** window, the Gate itself must not operate. So it is internally shut off while the gate view window is being updated. For the Swept SA measurement, this means that the Gate is internally shut off whenever the gate view window is displayed. The measurement bar and softkeys continue to show the Trigger source for the main sweep window and give no indication that the Gate is shut off or that the Gate View window is triggered from the Gate Source.

When in **Gate View**, vertical lines are displayed in the Gate View window as follows:

- Green lines are displayed at the gate edges as follows: in Edge Gate, a line is shown for Delay and one for the end of the Gate period (defined by Length, even in FFT. In Level Gate a line is shown only for Delay. You can adjust the position of the green lines by adjusting the gate length and the gate delay. These lines update in the Gate View window as the active function changes, even if the window is not being updated. In Gated LO and Gated Video, these lines are positioned relative to the delay reference line (not relative to 0 time). In Gated FFT, their location is relative to the left edge of the screen.
- A blue line is displayed showing the delay reference, that is, the reference point for the Gate Delay within the Zero Span window. The blue line represents where (in time) the effective location of the gate start would be if the gate were programmed to zero delay.
- The second blue line is labeled "MIN FAST" as shown in the figure above because it represents the minimum Gate Delay for fast Gated LO operation. This line is only displayed in Gated LO. You cannot scroll (knob) or decrement (down key) the Gate Delay to less than that represented by the position of this line, it can only be set below this position manually, although once there it can be moved freely with the knob while below the line.
- A yellow line in the Gated Video case only, is displayed at Blength, where Blength is the display point (bucket) length for the swept trace, which is given by the sweep time for that trace divided by number of Points – 1. So it is referenced to 0 time, not to the delay reference. This line is labeled NEXT PT (it is not shown in the figure above because the figure above is for Gated LO). The yellow line represents the edge of a display point (bucket). Normally in Gated Video, the bucket length must be selected so that it exceeds the off time of the burst. There is another way to use the analyzer in Gated Video measurements, and that is to set the bucket width much shorter than the off time of the burst. Then use the Max Hold trace function to fill in "missing" buckets more slowly. This allows you to see some of the patterns of the Gated Video results earlier, though seeing a completely filled-in spectrum later.

Gate View Sweep Time

Controls the sweep time in the Gate View window. To provide an optimal view of the gate signal, the analyzer initializes Gate View Sweep Time based on the current settings of Gate Delay and Gate Length.

Key Path	**Sweep/Control, Gate**

Remote Command	`[:SENSe]:SWEep:EGATe:TIME <time>` `[:SENSe]:SWEep:EGATe:TIME?`
Example	SWE:EGAT:TIME 500 ms
Dependencies	Gate View Sweep Time is initialized: On Preset (after initializing delay and length). Every time the Gate Method is set/changed. Additionally, in the Swept SA measurement, whenever you do a Preset, or leave Gate View, the analyzer remembers the Gate Delay and Gate Length settings. Then, when returning to Gate View, if the current Gate Delay and/or Gate Length do not match the remembered values Gate View Sweep Time is re-initialized. 1. Compute the location of the "gate stop" line, which you know is at time t = tmin + GateDelay + GateLength.
Preset	519.3 µs WiMAX OFDMA: 5 ms GSM/EDGE: 1 ms
State Saved	Saved in instrument state
Min	1 µs
Max	6000 s
Initial S/W Revision	Prior to A.02.00

Gate Delay

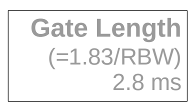
Controls the length of time from the time the gate condition goes True until the gate is turned on.

Key Path	**Sweep/Control, Gate**
Remote Command	`[:SENSe]:SWEep:EGATe:DELay <time>` `[:SENSe]:SWEep:EGATe:DELay?`
Example	SWE:EGAT:DELay 500ms SWE:EGAT:DELay?
Notes	Units of time are required or no units; otherwise an invalid suffix error will be generated. See error –131.
Preset	57.7 us WiMAX OFDMA: 71 us GSM/EDGE: 600 us
State Saved	Saved in instrument state
Min	0.0 us

Max	100 s
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE:DELay
Initial S/W Revision	Prior to A.02.00

Gate Length

Controls the length of time that the gate is on after it opens.

Key Path	**Sweep/Control, Gate**
Remote Command	`[:SENSe]:SWEep:EGATe:LENGth <time>` `[:SENSe]:SWEep:EGATe:LENGth?`
Example	SWE:EGAT:LENG 1 SWE:EGAT:LENG?
Notes	Units of time are required or no units; otherwise an invalid suffix will be generated.
Dependencies	Grayed out when Gate Method is set to FFT in which case the label changes to that shown below.  vsd 39-1 The key is also grayed out if Gate Control = Level.
Preset	461.6 us WiMAX OFDMA: 50 us GSM/EDGE: 200 us
State Saved	Saved in instrument state
Min	100 ns
Max	5 s
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE:LENGth
Initial S/W Revision	Prior to A.02.00

Method

This lets you choose one of the three different types of gating.

Not all types of gating are available for all measurements.

Key Path	**Sweep/Control, Gate**
Remote Command	`[:SENSe]:SWEep:EGATe:METHod LO|VIDeo|FFT` `[:SENSe]:SWEep:EGATe:METHod?`

Example	SWE:EGAT:METH FFT
Preset	LO
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

LO

When Gate is set to On, the LO sweeps whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating is more sophisticated, and results in faster measurements. With Gated LO, the analyzer only sweeps while the gate conditions are satisfied. This means that a sweep could take place over several gate events. It would start when the gate signal goes true and stop when it goes false, and then continue when it goes true again. But since the LO is sweeping as long as the gate conditions are satisfied, the sweep typically finishes much more quickly than with Gated Video.

When in zero span, there is no actual sweep performed. But data is only taken while the gate conditions are satisfied. So even though there is no sweep, the gate settings will impact when data is acquired.

Key Path	**Sweep/Control, Gate, Method**
Dependencies	Key is unavailable when Gate is On and FFT Sweep Type manually selected. When selected, Sweep Type is forced to Swept and the FFT key in Sweep Type is grayed out.
Readback	LO
Initial S/W Revision	Prior to A.02.00

Video

When Gate is set to On, the video signal is allowed to pass through whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating may be thought of as a simple switch, which connects the signal to the input of the spectrum analyzer. When the gate conditions are satisfied, the switch is closed, and when the gate conditions are not satisfied, the switch is open. So we only look at the signal while the gate conditions are satisfied.

With this type of gating, you usually set the analyzer to sweep very slowly. In fact, a general rule is to sweep slowly enough that the gate is guaranteed to be closed at least once per data measurement interval (bucket). Then if the peak detector is used, each bucket will represent the peak signal as it looks with the gate closed.

Key Path	**Sweep/Control, Gate, Method**
Dependencies	Key is unavailable when Gate is On and FFT Sweep Type manually selected. When selected, Sweep Type is forced to Swept and the FFT key in Sweep Type is grayed out
Readback	Video
Initial S/W Revision	Prior to A.02.00

FFT

When Gate is set to On, an FFT is performed whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source. This is an FFT measurement which begins when the gate conditions are satisfied. Since the time period of an FFT is approximately 1.83/RBW, you get a measurement that starts under predefined conditions and takes place over a predefined period. So, in essence, this is a gated measurement. You have limited control over the gate length but it works in FFT sweeps, which the other two methods do not.

Gated FFT cannot be done in zero span since the instrument is not sweeping. So in zero span the Gated LO method is used. Data is still only taken while the gate conditions are satisfied, so the gate settings do impact when data is acquired.

The Gate Length will be 1.83/RBW.

This is a convenient way to make a triggered FFT measurement under control of an external gating signal.

Key Path	**Sweep/Control, Gate**
Dependencies	Key is unavailable when Gate is On and Swept Sweep Type manually selected. Key is unavailable when gate Control is set to Level. When selected, Sweep Type is forced to FFT and the Swept key in Sweep Type is grayed out Forces Gate Length to 1.83/RBW
Readback	FFT
Initial S/W Revision	Prior to A.02.00

Gate Source

The menus under the **Gate Source** key follow the same pattern as those under the **Trigger key**, with the exception that neither **Free Run** nor **Video** are available as Gate Source selections. Any changes to the settings in the setup menus under each Gate Source selection key (for example: **Trigger Level**) also affect the settings under the Trigger menu keys. Note that the selected Trigger Source does not have to match the Gate Source.

Key Path	**Sweep/Control, Gate**
Remote Command	`[:SENSe]:SWEep:EGATe:SOURce EXTernal1|EXTernal2 |LINE|FRAMe|RFBurst` `[:SENSe]:SWEep:EGATe:SOURce?`
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error
Preset	EXTernal 1 GSM/EDGE: FRAMe
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Control Edge/Level

Sets the method of controlling the gating function from the gating signal.

Edge

In Edge triggering, the gate opens (after the Delay) on the selected edge (for example, positive) of the gate signal and closes on the alternate edge (for example, negative).

Level

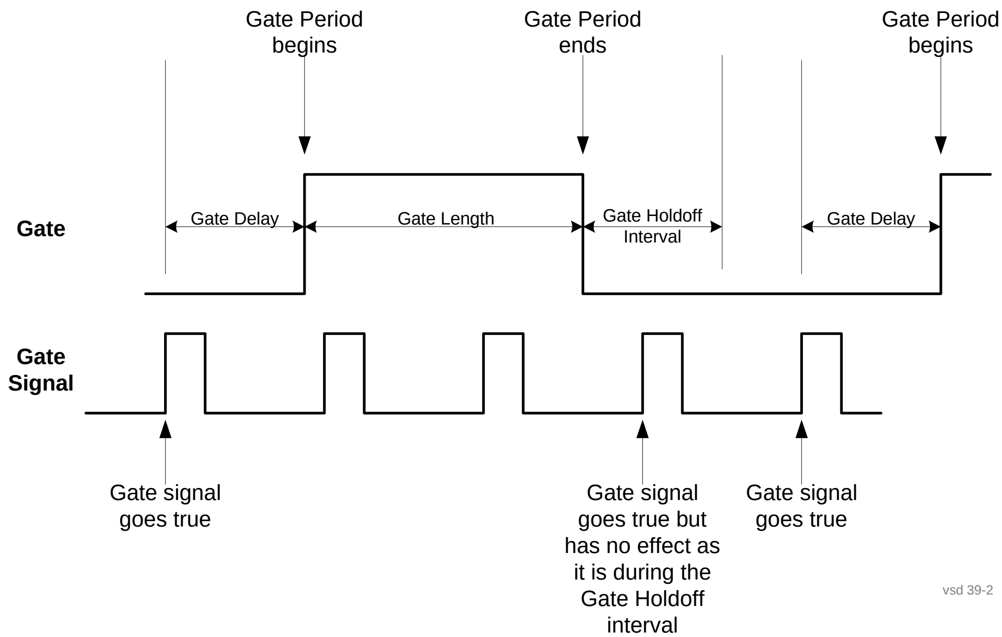
In Level triggering, the gate opens (after the Delay) when the gate signal has achieved a certain level and stays open as long as that level is maintained.

Key Path	**Sweep/Control, Gate**
Remote Command	`[:SENSe]:SWEep:EGATe:CONTrol EDGE|LEVel` `[:SENSe]:SWEep:EGATe:CONTrol?`
Example	SWE:EGAT:CONT EDGE
Dependencies	If the Gate Method is FFT the Control key is grayed out and Edge is selected. If the Gate Source is TV, Frame or Line, the Control key is grayed out and Edge is selected.
Preset	EDGE
State Saved	Saved in instrument state
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE:TYPE
Initial S/W Revision	Prior to A.02.00

Gate Holdoff

Lets you increase or decrease the wait time after a gate event ends before the analyzer will respond to the next gate signal.

After any Gate event finishes, the analyzer must wait for the sweep system to settle before it can respond to another Gate signal. The analyzer calculates a "wait time," taking into account a number of factors, including RBW and Phase Noise Optimization settings. The goal is to achieve the same accuracy when gated as in ungated operation. The figure below illustrates this concept:



When Gate Holdoff is in Auto, the wait time calculated by the analyzer is used. When Gate Time is in Manual, the user may adjust the wait time, usually decreasing it in order to achieve greater speed, but at the risk of decreasing accuracy.

When the **Method** key is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect.

In measurements that do not support Auto, the value shown when Auto is selected is “---“ and the manually set holdoff is returned to a query.

Key Path	**Sweep/Control, Gate**

Remote Command	`[:SENSe]:SWEep:EGATe:HOLDoff <time>`
	`[:SENSe]:SWEep:EGATe:HOLDoff?`
	`[:SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF|ON|0|1`
	`[:SENSe]:SWEep:EGATe:HOLDoff:AUTO?`

Example	SWE:EGAT:HOLD 0.0002 SWE:EGAT:HOLD? SWE:EGAT:HOLD:AUTO ON SWE:EGAT:HOLD:AUTO?

Couplings	When **Gate Holdoff** is **Auto**, the **Gate Holdoff** key shows the value calculated by the analyzer for the wait time. Pressing the **Gate Holdoff** key while it is in **Auto** and not selected, causes the key to become selected and allows the user to adjust the value. If the value is adjusted, the setting changes to **Man**. Pressing the **Gate Holdoff** key, while it is in **Auto** and selected, does not change the value of **Gate Holdoff**, but causes the setting to change to **Man.** Now the user can adjust the value. Pressing the key while it is in **Man** and selected, cause the value to change back to **Auto**. Pressing the key while it is in **Man** and not selected, causes the key to become selected and allows the user to adjust the value. When **Method** is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect.
Preset	Auto Auto/On
State Saved	Saved in instrument state
Min	1 µsec
Max	1 sec
Initial S/W Revision	Prior to A.02.00

Gate Delay Compensation

This function allows you to select an RBW-dependent value by which to adjust the gate delay, to compensate for changes in the delay caused by RBW effects.

Youcan select between uncompensated operation and two types of compensation, **Delay Until RBW Settled** and **Compensate for RBW Group Delay**.

See “More Information” on page 287

Key Path	**Sweep/Control, Gate**
Scope	Meas Global

Remote Command	`[:SENSe]:SWEep:EGATe:DELay:COMPensation:TYPE OFF|SETTled|GDELay`
	
	`[:SENSe]:SWEep:EGATe:DELay:COMPensation:TYPE?`

Example	SWE:EGAT:DEL:COMP:TYPE SETT SWE:EGAT:DEL:COMP:TYPE?

Notes	Although this function is Meas Global, there are some measurements that do not support this function. In those measurements the operation will be Uncompensated. Going into one of those measurements will not change the Meas Global selection; it will simply display the grayed-out menu key with “Uncompensated” showing as the selection. This is a non-forceful grayout, so the SCPI command is still accepted. If Gate Delay Compensation is not supported at all within a particular mode, the key is not displayed, and if the SCPI command is sent while in a measurement within that mode, an “Undefined Header” error is generated. Measurements that do not support this function include: Swept SA
Preset	TD-SCDMA mode: Compensate for RBW Group Delay All other modes: Delay Until RBW Settled
State Saved	Saved in instrument state
Range	Uncompensated|Delay Until RBW Settled|Compensate for RBW Group Delay
Readback text	Uncompensated|Settled|Group Delay
Initial S/W Revision	Prior to A.02.00

More Information

Selecting **Uncompensated** means that the actual gate delay is as you sets it.

Selecting **Delay Until RBW Settled** causes the gate delay to be increased above the user setting by an amount equal to 3.06/RBW. This compensated delay causes the GATE START and GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** key does NOT change.

Delay Until RBW Settled allows excellent measurements of gated signals, by allowing the IF to settle following any transient that affects the burst. Excellent measurements also require that the analysis region not extend into the region affected by the falling edge of the burst. Thus, excellent measurements can only be made over a width that declines with narrowing RBWs. Therefore, for general purpose compensation, you will still want to change the gate length with changes in RBW even if the gate delay is compensated.

Selecting **Compensate for RBW Group Delay** causes the gate delay to be increased above the user setting by an amount equal to 1.81/RBW. This compensated delay causes the GATE START, GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** key does NOT change. **Compensate for RBW Group Delay** also includes gate length compensation; the gate length itself is adjusted as necessary to attempt to compensate for delay effects imposed by the RBW.

Compensate for RBW Group Delay is similar to **Delay Until RBW Settled** , but compensates for the group delay of the RBW filter, rather than the filter settling time. As the RBW gets narrow, this can allow the settling tail of the RBW to affect the beginning part of the gated measurement, and allow the beginning of the RBW settling transient to affect the end of the gated measurement. These two effects are symmetric because the RBW response is symmetric. Because the gate length is not automatically compensated, some users might find this compensation to be more intuitive than compensation for RBW settling.

Min Fast Position Query (Remote Command Only)

This command queries the position of the MIN FAST line, relative to the delay reference (REF) line. See section "Gate View On/Off" on page 276. If this query is sent while not in gate view, the MinFast calculation is performed based on the current values of the appropriate parameters and the result is returned. Knowing this value lets you set an optimal gate delay value for the current measurement setup.

Remote Command:	`[:SENSe]:SWEep:EGATe:MINFast?`
Example:	SWE:EGAT:MIN?
Initial S/W Revision:	Prior to A.02.00

Points

Sets the number of points taken per sweep, and displayed in the traces. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display. Using more points provides greater resolution; using fewer points compacts the data and decreases the time required to access a trace over the remote interface.

Increasing the number of points does not increase the sweep time; however, it can slightly impact the trace processing time and therefore the overall measurement speed. Decreasing the number of points does not decrease the sweep time, but it may speed up the measurement, depending on the other sweep settings (for example, in FFT sweeps). Fewer points will always speed up the I/O.

Due to minimum sweep rate limitations of the hardware, the minimum sweep time available to the user will increase above its normal value of 1 ms as the number of sweep points increases above 15001.

Changing the number of sweep points has several effects on the analyzer. The sweep time resolution will change. Trace data for all the traces will be cleared and, if Sweep is in Cont, a new trace taken. If any trace is in average or hold, the averaging starts over.

When sweep points is changed, an informational message is displayed, "Sweep points changed, all traces cleared."

Key Path	**Sweep**
Remote Command	`[:SENSe]:SWEep:POINts <integer>` `[:SENSe]:SWEep:POINts?`
Example	SWE:POIN 5001 SWE:POIN?
Dependencies	Grayed out in measurements that do not support swept Blanked in modes that do not support swept.

Couplings	Will be affected by: log sweep Whenever the number of sweep points change: All trace data is erased Any traces with Update Off will also go to Display Off (like going from View to Blank in the older analyzers) Sweep time is re-quantized Any limit lines that are on will be updated If averaging/hold is on, averaging/hold starts over
Preset	1001
State Saved	Saved in instrument state
Min	1
Max	40001
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Abort (Remote Command Only)

This command is used to stop the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the analyzer is in the process of aligning when ABORt is sent, the alignment finishes before the abort function is performed. So ABORt does not abort an alignment.

If the analyzer is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

Remote Command:	`:ABORt`
Example:	:ABOR
Notes:	If :INITiate:CONTinuous is ON, then a new continuous measurement will start immediately; with sweep (data acquisition) occurring once the trigger condition has been met. If :INITiate:CONTinuous is OFF, then :INITiate:IMMediate is used to start a single measurement; with sweep (data acquisition) occurring once the trigger condition has been met.
Dependencies:	For continuous measurement, ABORt is equivalent to the Restart key. Not all measurements support the abort command.

Status Bits/OPC dependencies:	The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUEStionable register bit 9 (INTegrity sum) is cleared. Since all the bits that feed into OPC are cleared by the ABORt, the ABORt will cause the *OPC query to return true.
Initial S/W Revision:	Prior to A.02.00

Trigger

Accesses a menu of keys to control the selection of the trigger source and the setup of each of the trigger sources. The analyzer is designed to allow triggering from a number of different sources, for example, Free Run, Video, External, RF Burst, and so forth.

The TRIG:SOURCe command (below) will specify the trigger source for the currently selected input (RF or I/Q). If you change inputs, the new input remembers the trigger source it was last programmed to for the current measurement, and uses that trigger source. You can directly set the trigger source for each input using the TRIGger:RF:SOURce and TRIGger:IQ:SOURce commands (later in this section).

Note the inclusion of the <measurement> parameter in the command below. Because each measurement remembers its own Trigger Source, the command must be qualified with the measurement name. Note that for the Swept SA measurement this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement.

See "Trigger Source Presets" on page 291

See "RF Trigger Source" on page 294

See "I/Q Trigger Source" on page 296

See "More Information" on page 297

Remote Command	`:TRIGger:<measurement>[:SEQuence]:SOURce EXTernal1|EXTernal2|IMMediate|LINE|FRAMe|RFBurst|VIDeo|IF|ALARm|LAN|IQMag|IDEMod|QDEMod|IINPut|QINPut|AIQMag` `:TRIGger:<measurement>[:SEQuence]:SOURce?`
Example	TRIG:ACP:SOUR EXT1 Selects the external 1 trigger input for the ACP measurement and the selected input TRIG:SOUR VID Selects video triggering for the SANalyzer measurement in the Spectrum Analyzer mode. For SAN, do not use the <measurement> keyword.
Initial S/W Revision	Prior to A.02.00
Key Path	**Front-panel key**

Notes	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available. Not all trigger sources are available for each input. See the “RF Trigger Source” on page 294 and “I/Q Trigger Source” on page 296 commands for detailed information on which trigger sources are available for each input. Other trigger-related commands are found in the INITiate and ABORt SCPI command subsystems. *OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned. Available ranges and presets can vary from mode to mode.
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error
Preset	See table below
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Backwards Compatibility SCPI	[:SENSe]:<measurement>:TRIGger:SOURce This backwards compatibility command does not apply to the Swept SA measurement, for that just use :TRIGger:SOURCe This backwards compatibility command does not apply to the monitor spectrum, log plot and spot frequency measurements at all. The backwards Compatibility SCPI command, [:SENSe]:ACPR:TRIGger:SOURce, is provided to support the same functionality as [:SENSe]:ACPr:TRIGger:SOURce (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to the fact that the ACPr node conflicts with the ACPower node. In earlier instruments, the parameter IF was used by apps for the video trigger, so using the IF enum selects video triggering. Sending IF in the command causes VID to be returned to a query.
Modified at S/W Revision	A.03.00

Trigger Source Presets

Here are the Trigger Source Presets for the various measurements:

Meas	Mode	Preset for RF	Preset for IQ	Notes

Swept SA	SA	IMM	IQ not supported	
CHP	SA, WCDMA, C2K, WIMAX OFDMA, 1xEVDO, DVB-T/H, DTMB, LTE, LTETDD	IMM	IQ not supported	
OBW	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEVDO, LTE, LTETDD	1xEVDO: EXT1 others: IMM	IQ not supported	For 1xEVDO mode, the trigger source is coupled with the gate state, as well as the gate source. When the trigger source changes to RFBurst, External1 or External2, the gate state is set to on, and the gate source is set identically with the trigger source. When the trigger source changes to IMMediate, VIDeo, LINE, FRAMe or IF, the gate state is set to off.
CCDF	SA, WCDMA, C2K, WIMAXOFDMA, TD-SCDMA, 1xEV-DO, DVB-T/H, DTMB, LTE, LTETDD	SA, WCDMA, C2K, LTE: IMMediate WIMAXOFDMA: RFBurst LTETDD: BTS: External 1 MS: Periodic Timer TD-SCDMA: BTS: External 1 MS: RFBurst	TD-SCDMA: BTS: External 1 MS: IQMag LTETDD: BTS: External 1 MS: Periodic Timer Others: IMM	For TD-SCDMA: Trigger source is coupled with radio device. When radio device changes to BTS, trigger source will be changed to EXTernal1. When radio device changes to MS, trigger source will be set as RFBurst for RF or IQ Mag for BBIQ. When TriggerSource is RFBurst or IQ Mag, Measure Interval is grayed out.
ACP	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEVDO, DVB-T/H, DTMB, LTE, LTETDD	IMM	IQ not supported	
Tx Power	SA, GSM, TD-SCDMA	SA, GSM: RFBurst TD-SCDMA: EXTernal	IMM	TD-SCDMA doesn't support the Line and Periodic Timer parameters. When the mode is TD-SCDMA, if the Radio Device is switched to BTS, the value will be changed to External 1 and if the Radio device is switched to MS, the value will be changed to RFBurst

SPUR	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA,1xEV-DO, DVB-T/H, LTE, LTETDD	IMM	IQ not supported	
SEM	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEVDO, DVB-T/H, DTMB, LTE, LTETDD	SA, WCDMA, C2K, TD-SCDMA, WIMAX OFDMA, LTE, LTETDD: IMMediate 1xEVDO(BTS): EXTernal1	IQ not supported	
CDP	WCDMA	IMM	IMM	
RHO	WCDMA	IMM	IMM	
PCON	WCDMA	IMM	IMM	
QPSK	WCDMA, C2K, 1xEVDO	All except CDMA1xEVDO: IMMediate CDMA1xEVDO: EXT1	IMM	
MON	All except SA and BASIC	IMM	IQ not supported	
WAV		LTETDD: BTS: External 1 MS: Periodic Timer GSM/EDGE: RFBurst All others: IMMediate	LTETDD: BTS: External 1 MS: Periodic Timer GSM/EDGE: IQMag All others: IMMMediate	
PVT	WIMAXOFDMA	RFB	IMM	
EVM	WIMAXOFDMA, DVB-T/H, DTMB, LTE, LTETDD	IMM	IMM	LTE, LTETDD supports Free Run, Video and External 1 only.
SPEC	BASIC	IMM	IMM	
LOG Plot	PN	IMM	IQ not supported	
Spot Freq	PN	IMM	IQ not supported	

GMSK PVT	EDGE/GSM	RFB	IMM	
GMSK PFER	EDGE/GSM	RFB	IQMag	
GMSK ORFS	EDGE/GSM	RFB	IQ not supported	
EDGE PVT	EDGE/GSM	RFB	IMM	
EDGE EVM	EDGE/GSM	RFB	IQMag	
EDGE ORFS	EDGE/GSM	RFB	IQ not supported	
Combine d WCDMA	WCDMA	IMM	IQ not supported	
Combine d GSM	EDGE/GSM	RFB	IQ not supported	
List Power Step	WCDMA, EDGE/GSM	IMM	IQ not supported	
Transmit On/Off Power	LTETDD	LTETDD: BTS: External 1 MS: Periodic Timer	LTETDD: BTS: External 1 MS: Periodic Timer	

RF Trigger Source

The **RF Trigger Source** command selects the trigger to be used for the specified measurement when RF is the selected input. The RF trigger source can be queried and changed even while another input is selected, but it is inactive until RF becomes the selected input.

Note the inclusion of the <measurement> parameter in the command below. Because each measurement remembers its own Trigger Source, the command must be qualified with the measurement name. Note that for the Swept SA measurement this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement.

Remote Command:	`:TRIGger:<measurement>[:SEQuence]:RF:SOURce EXTernal1|EXTernal2|IMMediate|LINE|FRAMe|RFBurst|VIDeo|IF|ALARm|LAN`
	
	`:TRIGger:<measurement>[:SEQuence]:RF:SOURce?`

Example:	TRIG:ACP:RF:SOUR EXT1 Selects the external 1 trigger input for the ACP measurement and the RF input TRIG:RF:SOUR VID Selects video triggering for the SANalyzer measurement and the RF input. For SAN, do not use the <measurement> keyword.
Notes:	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available. Not all trigger sources are available for each input. For the **RF Trigger Source,** the following trigger sources are available: — IMMediate - free run triggering — VIDeo - triggers on the video signal level — LINE - triggers on the power line signal — EXTernal1 - triggers on an externally connected trigger source marked “Trigger 1 In” on the rear panel — EXTernal2 - triggers on an externally connected trigger source marked “Trigger 2 In” on the front panel. In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error — RFBurst - triggers on the bursted frame — FRAMe - triggers on the periodic timer — IF (video) - same as video, for backwards compatibility only — ALARm – LXI Alarm — LAN – LXI LAN event *OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned. Available ranges, and presets can vary from mode to mode.
Status Bits/OPC dependencies:	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Backwards Compatibility SCPI:	In earlier instruments, the parameter IF was used by apps for the video trigger, so using the IF enum selects video triggering. Sending IF in the query returns the VID enum.
Initial S/W Revision:	Prior to A.02.00

I/Q Trigger Source

This command selects the trigger to be used for the specified measurement when I/Q (which requires option BBA) is the selected input. The I/Q trigger source can be queried and changed even while another input is selected, but it is inactive until I/Q becomes the selected input.

Remote Command:	`:TRIGger:<measurement>[:SEQuence]:IQ:SOURce EXTernal1|EXTernal2|IMMediate|IQMag|IDEMod|QDEMod|IINPut|QINPut|AIQMag` `:TRIGger:<measurement>[:SEQuence]:IQ:SOURce?`
Example:	TRIG:WAVeform:SOUR IQM Selects I/Q magnitude triggering for the IQ Waveform measurement and the I/Q input
Notes:	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available. Not all trigger sources are available for each input. For the **I/Q Trigger Source,** the following trigger sources are available: — IMMediate - free run triggering — EXTernal1 - triggers on an externally connected trigger source on the rear panel — EXTernal2 - triggers on an externally connected trigger source on the front panel — IQMag - triggers on the magnitude of the I/Q signal — IDEMod - triggers on the I/Q signal's demodulated I voltage — QDEMod - triggers on the I/Q signal's demodulated Q voltage — IINPut - triggers on the I channel's ADC voltage — QINPut - triggers on the Q channel's ADC voltage — AIQMag - triggers on the magnitude of the auxiliary receiver channel I/Q signal *OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned. Available ranges, an from mode to mode.d presets can vary
Status Bits/OPC dependencies:	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision:	Prior to A.02.00

More Information

The trigger menus let you select the trigger source and trigger settings for a sweep or measurement. In triggered operation (basically, any trigger source other than Free Run), the analyzer will begin a sweep or measurement only with the selected trigger conditions are met, generally when your trigger source signal meets the specified trigger level and polarity requirements. (In FFT measurements, the trigger controls when the data acquisition begins for FFT conversion.)

For each of the trigger sources, you may define a set of operational parameters or settings which will be applied when that source is selected as the current trigger source. Examples of these settings are Trigger Level, Trigger Delay, and Trigger Slope. You may apply different settings for each source; so, for example, you could have a Trigger Level of 1v for External 1 trigger and –10 dBm for Video trigger.

Once you have established the settings for a given trigger source, they generally will remain unchanged for that trigger source as you go from measurement to measurement within a Mode (although the settings do change as you go from Mode to Mode). Furthermore, the trigger settings within a Mode are the same for the **Trigger** menu, the **Gate Source** menu, and the **Sync Source** menu that is part of the **Periodic Timer Trigger Setup** menu. That is, if **Ext1** trigger level is set to 1v in the **Trigger** menu, it will appear as 1v in both the **Gate Source** and the **Sync Source** menus. For these reasons the trigger settings commands are not qualified with the measurement name, the way the trigger source commands are.

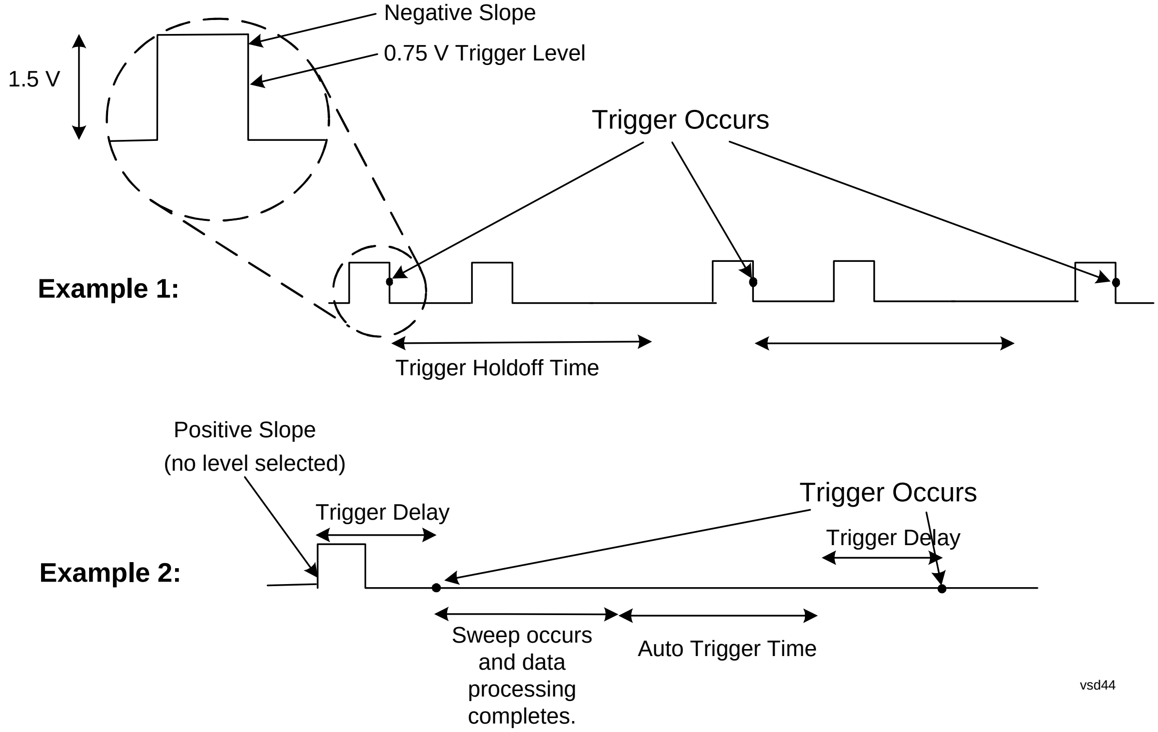
The settings setup menu can be accessed by pressing the key for the current trigger source a second time. For example, one press of Video selects the Video trigger as the source. The Video key becomes highlighted and the hollow arrow on the key turns black. Now a second press of the key takes you into the Video Trigger Setup menu.

Trigger Setup Parameters:

The following examples show trigger setup parameters using an external trigger source.

Example 1 illustrates the trigger conditions with negative slope and no trigger occurs during trigger Holdoff time.

Example 2 illustrates the trigger conditions with positive slope, trigger delay, and auto trigger time.



Free Run

Pressing this key, when it is not selected, selects free-run triggering. Free run triggering occurs immediately after the sweep/measurement is initiated.

Key Path	**Trigger**
Example	TRIG:SOUR IMM ! Swept SA measurement TRIG:<meas>:SOUR IMM ! Measurements other than Swept SA
State Saved	Saved in instrument state
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00

Video (IF Envelope)

Pressing this key, when it is not selected, selects the video signal as the trigger. The Video trigger condition is met when the video signal (the filtered and detected version of the input signal, including both RBW and VBW filtering) crosses the video trigger level.

NOTE When the detector selected for all active traces is the average detector, the video signal for triggering does not include any VBW filtering.

The video trigger level is shown as a labeled line on the display. The line is displayed as long as video is the selected trigger source.

Pressing this key, when it is already selected, accesses the video trigger setup functions.

Key Path	**Trigger**
Example	TRIG:SOUR VID ! Swept SA measurement TRIG:<meas>:SOUR VID ! Measurements other than Swept SA
Notes	Log Plot and Spot Frequency measurements do not support Video Trigger
Dependencies	Video trigger is allowed in average detector mode.
State Saved	Saved in instrument state
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets a level for the video signal trigger. When the video signal crosses this level, with the chosen slope, the trigger occurs. This level is displayed with a horizontal line only if **Video** is the selected trigger source.

Remote Command	`:TRIGger[:SEQuence]:VIDeo:LEVel <ampl>` `:TRIGger[:SEQuence]:VIDeo:LEVel?`
Example	TRIG:VID:LEV –40 dBm
Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00
Key Path	**Trigger, Video**

Notes	When sweep type = FFT, the video trigger uses the amplitude envelope in a bandwidth wider than the FFT width as a trigger source. This might often be useful, but does not have the same relationship between the displayed trace and the trigger level as in swept triggering. Amplitude Corrections are not taken into account by the Video Trig Level. For example, if you have given yourself effective gain with an amplitude correction factor, the Video Trigger will not fire until you have dropped the trigger line that far below the displayed signal level, rather than simply dropping it down to the displayed signal level. Note that other corrections, specifically External Gain and Ref Level Offset, modify the actual trace data as it is taken and therefore ARE taken into account by Trig Level.
Couplings	This same level is used for the Video trigger source in the Trigger menu and for the Video selection in the Gate Source menu.
Preset	Set the Video Trigger Level –25 dBm on Preset. When the Video Trigger Level becomes the active function, if the value is off screen, set it to either the top or bottom of screen, depending on which direction off screen it was.
State Saved	Saved in instrument state
Min	–170 dBm
Max	+30 dBm
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:IF:LEVel :TRIGger[:SEQuence]:IF:LEVel?
Backwards Compatibility SCPI	For backward compatibility with VSA/PSA comms apps, we need this alias.

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Video**

Remote Command	`:TRIGger[:SEQuence]:VIDeo:SLOPe POSitive|NEGative`
	
	`:TRIGger[:SEQuence]:VIDeo:SLOPe?`

Example	TRIG:VID:SLOP NEG
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:SLOPe :TRIGger[:SEQuence]:IF:SLOPe

Backwards Compatibility SCPI	For backward compatibility, the following commands should update all instances of trigger slope (video/external/line). The query returns the trigger slope setting of the selected trigger source. :TRIGger[:SEQuence]:SLOPe POSitive|NEGative :TRIGger[:SEQuence]:SLOPe? For backward compatibility with VSA/PSA comms apps, we need to alias :TRIGger[:SEQuence]:IF:SLOPe NEGative|POSitive :TRIGger[:SEQuence]:IF:SLOPe?
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during that the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in the time domain or FFT, but not in swept spans.

Key Path	**Trigger, Video**

Remote Command	`:TRIGger[:SEQuence]:VIDeo:DELay <time>`
	`:TRIGger[:SEQuence]:VIDeo:DELay?`
	`:TRIGger[:SEQuence]:VIDeo:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:VIDeo:DELay:STATe?`

Example	TRIG:VID:DEL:STAT ON TRIG:VID:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. In swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.
Preset	Off, 1 us
State Saved	Saved in instrument state
Min	–150 ms
Max	+500 ms
Default Unit	s
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:IF:DELay :TRIGger[:SEQuence]:DELay

Backwards Compatibility SCPI	For backward compatibility with VSA/PSA comms apps, we need to alias Video trigger to :TRIGger[:SEQuence]:IF:DELay <time> :TRIGger[:SEQuence]:IF:DELay? For backward compatibility, the following commands should update all instances of trigger delay (not including RF Burst). The query returns the video trigger delay settings of the selected trigger source. :TRIGger[:SEQuence]:DELay <time> :TRIGger[:SEQuence]:DELay? :TRIGger[:SEQuence]:DELay:STATe OFF|ON|0|1 :TRIGger[:SEQuence]:DELay:STATe? Also, the legacy ESA command for trigger offset, TRIGger[:SEQuence]:OFFSet, is supported (see section "Trigger Offset (Remote Command Only)" on page 349). The offset specified by this commands is remembered by the analyzer and added to the video trigger delay whenever the value is sent to the hardware, when in zero span and in a Res BW >= 1 kHz.
Initial S/W Revision	Prior to A.02.00

Line

Pressing this key, when it is not selected, selects the line signal as the trigger. A new sweep/measurement will start synchronized with the next cycle of the line voltage. Pressing this key, when it is already selected, access the line trigger setup menu.

Key Path	**Trigger**
Example	TRIG:SOUR LINE ! Swept SA measurement TRIG:<meas>:SOUR LINE ! Measurements other than Swept SA
Dependencies	Line trigger is not available when operating from a "dc power source", for example, when the instrument is powered from batteries.
State Saved	Saved in instrument state
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Line**
Remote Command	`:TRIGger[:SEQuence]:LINE:SLOPe POSitive|NEGative` `:TRIGger[:SEQuence]:LINE:SLOPe?`
Example	TRIG:LINE:SLOP NEG
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:SLOPe (There are SLOPe backward compatibility commands.)
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	**Trigger, Line**

Remote Command	`:TRIGger[:SEQuence]:LINE:DELay <time>`
	`:TRIGger[:SEQuence]:LINE:DELay?`
	`:TRIGger[:SEQuence]:LINE:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:LINE:DELay:STATe?`

Example	TRIG:LINE:DEL:STAT ON TRIG:LINE:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. In swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	–150 ms
Max	500 ms
Default Unit	S

Backwards Compatibility SCPI	There are DELay backward compatibility commands described in video, Section "Trig Delay " on page 301) :TRIGger[:SEQuence]:DELay (Also, the legacy ESA command for trigger offset, TRIGger[:SEQuence]:OFFSet, is supported. See section "Trigger Offset (Remote Command Only)" on page 349. The offset specified by this commands is remembered by the analyzer and added to the line trigger delay whenever the value is sent to the hardware, when in zero span and in a Res BW >= 1 kHz.)
Initial S/W Revision	Prior to A.02.00

External 1

Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met using the external 1 input connector on the rear panel.

Pressing this key, when it is already selected, accesses the external 1 trigger setup menu.

Key Path	**Trigger**
Example	TRIG:SOUR EXT1 ! Swept SA measurement TRIG:<meas>:SOUR EXT1 ! Measurements other than Swept SA
State Saved	Saved in instrument state
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets the value where the external 1 trigger input will trigger a new sweep/measurement.

Key Path	**Trigger, External 1**
Remote Command	`:TRIGger[:SEQuence]:EXTernal1:LEVel <level>` `:TRIGger[:SEQuence]:EXTernal1:LEVel?`
Example	TRIG:EXT1:LEV 0.4 V
Couplings	This same level is used for the Ext1 trigger source in the Trigger menu, for the Ext1 selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the Ext1 selection in the Gate Source menu.
Preset	1.2 V

State Saved	Saved in instrument state
Min	–5 V
Max	5 V
Default Unit	V
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:EXTernal:LEVel (For backward compatibility, EXTernal should also work.)
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, External 1**
Remote Command	`:TRIGger[:SEQuence]:EXTernal1:SLOPe POSitive|NEGative` `:TRIGger[:SEQuence]:EXTernal1:SLOPe?`
Example	TRIG:EXT1:SLOP NEG
Couplings	This same slope is used in the Ext1 selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility SCPI	For backward compatibility, EXTernal should also work. Also, there are SLOPe backward compatibility cmds described in Video section "Trig Slope " on page 300 :TRIGger[:SEQuence]:SLOPe
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	**Trigger, External 1**

Remote Command	`:TRIGger[:SEQuence]:EXTernal1:DELay <time>`
	`:TRIGger[:SEQuence]:EXTernal1:DELay?`
	`:TRIGger[:SEQuence]:EXTernal1:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:EXTernal1:DELay:STATe?`

Example	TRIG:EXT1:DEL:STAT ON TRIG:EXT1:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. In swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	–150 ms
Max	+500 ms
Default Unit	s
Backwards Compatibility SCPI	For backward compatibility, EXTernal should also work. Also, there are DELay backward compatibility commands described in video section “Trig Delay ” on page 301 :TRIGger[:SEQuence]:DELay Also, the legacy ESA command for trigger offset, TRIGger[:SEQuence]:OFFSet, is supported (see section “Trigger Offset (Remote Command Only)” on page 349). The offset specified by this commands is remembered by the analyzer and added to the external1 trigger delay whenever the value is sent to the hardware, when in zero span and in a Res BW >= 1 kHz.
Initial S/W Revision	Prior to A.02.00

External 2

Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met using the external 2 input connector. The external trigger 2 input connector is on the rear panel.

Pressing this key, when it is already selected, accesses the external 2 trigger setup menu.

Key Path	**Trigger**
Example	TRIG:SOUR EXT2 ! Swept SA measurement TRIG:<meas>:SOUR EXT2 ! Measurements other than Swept SA
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error
State Saved	Saved in instrument state

Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Trigger Level

Sets the value where the external 2 trigger input will trigger a new sweep/measurement.

Key Path	**Trigger, External 2**
Remote Command	`:TRIGger[:SEQuence]:EXTernal2:LEVel` `:TRIGger[:SEQuence]:EXTernal2:LEVel?`
Example	TRIG:EXT2:LEV 1.1 V
Couplings	This same level is used for the Ext2 trigger source in the Trigger menu, for the Ext2 selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the Ext2 selection in the Gate Source menu.
Preset	1.2 V
State Saved	Saved in instrument state
Min	–5 V
Max	5 V
Default Unit	V
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, External 2**
Remote Command	`:TRIGger[:SEQuence]:EXTernal2:SLOPe POSitive|NEGative` `:TRIGger[:SEQuence]:EXTernal2:SLOPe?`
Example	TRIG:EXT2:SLOP NEG
Couplings	This same slope is used in the Ext2 selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive

State Saved	Saved in instrument state
Backwards Compatibility SCPI	Also, there are SLOPe backward compatibility commands described in Video, section :TRIGger[:SEQuence]:SLOPe
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	**Trigger, External 2**

Remote Command	`:TRIGger[:SEQuence]:EXTernal2:DELay <time>`
	`:TRIGger[:SEQuence]:EXTernal2:DELay?`
	`:TRIGger[:SEQuence]:EXTernal2:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:EXTernal2:DELay:STATe?`

Example	TRIG:EXT2:DEL:STAT ON TRIG:EXT2:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. In swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	–150 ms
Max	500 ms
Default Unit	s
Backwards Compatibility SCPI	Also, there are DELay backward compatibility commands described in video section “Trig Delay ” on page 301. :TRIGger[:SEQuence]:DELay Also, the legacy ESA command for trigger offset, TRIGger[:SEQuence]:OFFSet, is supported (see section “Trigger Offset (Remote Command Only)” on page 349). The offset specified by this commands is remembered by the analyzer and added to the external2 trigger delay whenever the value is sent to the hardware, when in zero span and in a Res BW >= 1 kHz.
Initial S/W Revision	Prior to A.02.00

RF Burst

Pressing this key, when it is not selected, selects the RF Burst as the trigger. A new sweep/measurement will start when an RF burst envelope signal is identified from the signal at the RF Input connector. Pressing this key, when it is already selected, accesses the RF Burst trigger setup menu.

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The analyzer automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the analyzer.

Key Path	**Trigger**
Example	TRIG:SOUR RFB ! Swept SA measurement TRIG:<meas>:SOUR RFB ! Measurements other than Swept SA
State Saved	Saved in instrument state
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

Absolute Trigger Level

Sets the absolute trigger level for the RF burst envelope.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?`
Example	TRIG:RFB:LEV:ABS 10 dBm sets the trigger level of the RF burst envelope signal to the absolute level of 10 dBm
Default Unit	depends on the current selected Y-Axis unit
Initial S/W Revision	Prior to A.02.00
Key Path	**Trig, RF Burst**
Scope	Meas Global

Notes	Sending this command does not switch the setting from relative to absolute; to switch it you need to send the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command, below. Amplitude Corrections are not taken into account by the Absolute Trigger Level. For example, if you have given yourself effective gain with an amplitude correction factor, the Absolute Trigger will not fire until you have set the trigger level that far below the displayed signal level, rather than simply to the displayed signal level. This is only true for Amplitude Corrections, not External Gain or Ref Level Offset functions.
Couplings	This same level is used for the RF Burst trigger source in the Trigger menu, for the RF Burst selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the RF Burst selection in the Gate Source menu
Preset	–20 dBm
State Saved	Saved in state
Min	–200 dBm
Max	100 dBm
Modified at S/W Revision	A.04.00

Remote Command:	`:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE ABSolute|RELative`
	
	`:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE?`

Example:	TRIG:RFB:LEV:TYPE REL sets the trigger level type of the RF burst trigger to Relative.
Preset:	ABSolute
State Saved:	Saved in State
Key Path:	**Trig, RF Burst**
Initial S/W Revision:	Prior to A.02.00
Modified at S/W Revision:	A.04.00

Relative Trigger Level

Sets the relative trigger level for the RF burst envelope.

In some models, the relative burst trigger function is implemented in hardware. In other models, without the advanced triggering hardware required, the relative burst trigger function is implemented in software in some measurements, and is unavailable in other measurements.

When implemented in software, the relative RF Burst trigger function is implemented as follows:

The measurement starts with the absolute RF Burst trigger setting. If it can not get a trigger with that level, auto trigger fires and the acquisition starts anyway. After the acquisition, the measurement searches for the peak in the acquired waveform and saves it.

Now, in the next cycle of the measurement, the measurement determines a new absolute RF Burst level based on the peak value from the first measurement and the Relative RF Burst Trigger Level (always 0 or negative dB) set by the user. The following formula is used:

absolute RF Burst level = peak level of the previous acquisition + relative RF Burst level

If the new absolute RF Burst level differs from the previous by more than 0.5 dB, the new level is sent to the hardware; otherwise it is not updated (to avoid slowing down the acquisition)

Steps 2 and 3 repeat for subsequent measurements.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:RELative <rel_ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:RELative?`
Example	TRIG:RFB:LEV:REL –10 dB sets the trigger level of the RF burst envelope signal to the relative level of –10 dB
Default Unit	dB or dBc
Initial S/W Revision	Prior to A.02.00
Key Path	**Trig, RF Burst**
Scope	Meas Global
Notes	Sending this command does not switch the setting from absolute to relative; to switch it you need to send the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command, above. The relative trigger level is not available in some measurements. In those measurements the RELative parameter, and the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command (above), should generate an error if sent.
Dependencies	This key is grayed out and Absolute Trigger Level selected if the required hardware is not present in your analyzer and the current measurement does not support Relative triggering.
Preset	–6 dB GSM: –25 dB
State Saved	Saved in state
Min	–45 dB
Max	0 dB
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:RFBurst:LEVel Is aliased to: :TRIGger[:SEQuence]:RFBurst:LEVel:RELative because the PSA had ONLY relative burst triggering
Modified at S/W Revision	A.04.00

Trigger Slope

It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, RF Burst**
Remote Command	`:TRIGger[:SEQuence]:RFBurst:SLOPe POSitive|NEGative` `:TRIGger[:SEQuence]:RFBurst:SLOPe?`
Example	TRIG:RFB:SLOP NEG
Couplings	This same slope is used in the RF Burst selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility SCPI	Also, there are SLOPe backward compatibility commands described in Video section "Trig Slope " on page 300 :TRIGger[:SEQuence]:SLOPe
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	**Trigger, RF Burst**

Remote Command	`:TRIGger[:SEQuence]:RFBurst:DELay <time>`
	`:TRIGger[:SEQuence]:RFBurst:DELay?`
	`:TRIGger[:SEQuence]:RFBurst:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:RFBurst:DELay:STATe?`

Example	TRIG:RFB:DEL:STAT ON TRIG:RFB:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. In swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	–150 ms

Max	500 ms
Default Unit	s
Backwards Compatibility SCPI	Also, there are DELay backward compatibility commands described in video section “Trig Delay ” on page 301. :TRIGger[:SEQuence]:DELay
Initial S/W Revision	Prior to A.02.00

Periodic Timer (Frame Trigger)

Pressing this key, when it is not selected, selects the internal periodic timer signal as the trigger. Triggering occurrences are set by the **Period** parameter, which is modified by the **Sync Source** and **Offset**. Pressing this key, when it is already selected, accesses the periodic timer trigger setup functions.

If you do not have a sync source selected (it is Off), then the internal timer will not be synchronized with any external timing events.

Key Path	**Trigger**
Example	TRIG:SOUR FRAM ! Swept SA measurement TRIG:<meas>:SOUR FRAM ! Measurements other than Swept SA
State Saved	Saved in instrument state
Readback	[Sync: <value of Sync Source>], for example, [Sync: External 1]
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00

Periodic Timer Triggering:

This feature selects the internal periodic timer signal as the trigger. Trigger occurrences are set by the **Periodic Timer** parameter, which is modified by the **Sync Source** and **Offset**.

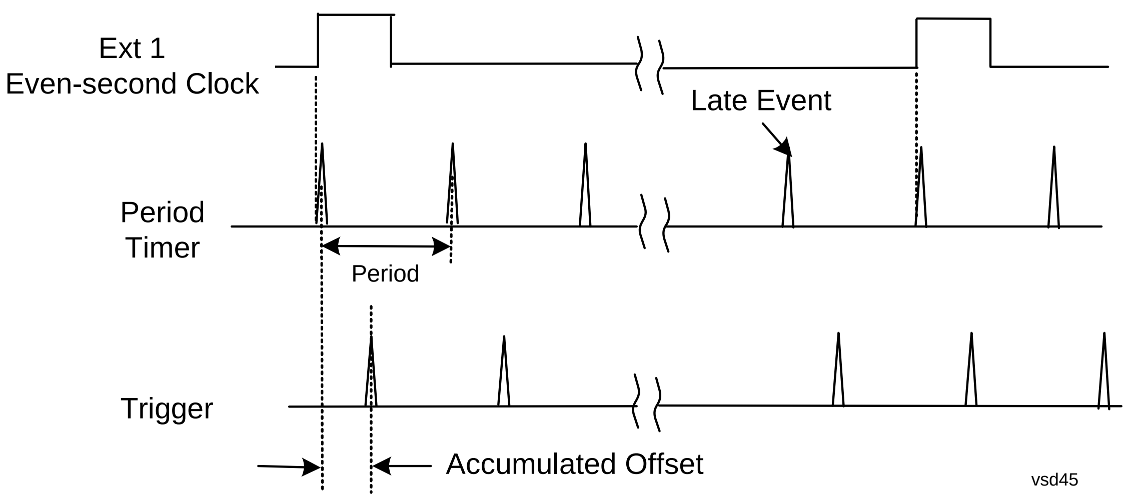
The figure below shows the action of the periodic timer trigger. Before reviewing the figure, we’ll explain some uses for the periodic trigger.

A common application is measuring periodic burst RF signals for which a trigger signal is not easily available. For example, we might be measuring a TDMA radio which bursts every 20 ms. Let’s assume that the 20 ms period is very consistent. Let’s also assume that we do not have an external trigger source available that is synchronized with the period, and that the signal-to-noise ratio of the signal is not high enough to provide a clean RF burst trigger at all of the analysis frequencies. For example, we might want to measure spurious transmissions at an offset from the carrier that is larger than the bandwidth of the RF burst trigger. In this application, we can set the Periodic Timer to a 20.00 ms period and adjust the offset from that timer to position our trigger just where we want it. If we find that the 20.00 ms is not exactly right, we can adjust the period slightly to minimize the drift between the period timer and the signal to be measured.

A second way to use this feature would be to use **Sync Source** temporarily, instead of **Offset**. In this case, we might tune to the signal in a narrow span and use the RF Burst trigger to synchronize the periodic timer. Then we would turn the sync source off so that it would not mis-trigger. Mis-triggering can occur when we are tuned so far away from the RF burst trigger that it is no longer reliable.

A third example would be to synchronize to a signal that has a reference time element of much longer period than the period of interest. In some CDMA applications, it is useful to look at signals with a short periodicity, by synchronizing that periodicity to the "even-second clock" edge that happens every two seconds. Thus, we could connect the even-second clock trigger to Ext1 and use then Ext1 as the sync source for the periodic timer.

The figure below illustrates this third example. The top trace represents the even-second clock. It causes the periodic timer to synchronize with the leading edge shown. The analyzer trigger occurs at a time delayed by the accumulated offset from the period trigger event. The periodic timer continues to run, and triggers continue to occur, with a periodicity determined by the analyzer time base. The timer output (labeled "late event") will drift away from its ideal time due to imperfect matching between the time base of the signal being measured and the time base of the analyzer, and also because of imperfect setting of the period parameter. But the synchronization is restored on the next even-second clock event. ("Accumulated offset" is described in the in the **Offset** function section.)



Period

Sets the period of the internal periodic timer clock. For digital communications signals, this is usually set to the frame period of your current input signal. In the case that sync source is not set to OFF, and the external sync source rate is changed for some reason, the periodic timer is synchronized at the every external synchronization pulse by resetting the internal state of the timer circuit.

Key Path	**Trigger, Periodic Timer**
Remote Command	`:TRIGger[:SEQuence]:FRAMe:PERiod <time>` `:TRIGger[:SEQuence]:FRAMe:PERiod?`
Example	TRIG:FRAM:PER 100 ms

Notes	Internal hardware resolution is 1/ (30 MHz 216) or about 0.5 ps. The manual UI resolution should be 1 ps. The remote command can be sent with more resolution but must be quantized to the hardware resolution when applied. Therefore, Joe Gorin proposed an internal software resolution smaller than 0.5 ps. Let’s choose 0.1 ps.
Dependencies	The invalid data indicator turns on when the period is changed, until the next sweep/measurement completes.
Couplings	The same period is used in the Gate Source selection of the period timer.
Preset	20 ms GSM: 4.615383
State Saved	Saved in instrument state
Min	100.000 ns
Max	559.0000 ms
Default Unit	S
Initial S/W Revision	Prior to A.02.00

Offset

Adjusts the accumulated offset between the periodic timer events and the trigger event. Adjusting the accumulated offset is different than setting an offset, and requires explanation.

The periodic timer is usually not synchronized with any external events, so the timing of its output events has no absolute meaning. Since the timing relative to external events (RF signals) is important, you need to be able to adjust (offset) it. However, you have no direct way to see when the periodic timer events occur. All that you can see is the trigger timing. When you want to adjust the trigger timing, you will be changing the internal offset between the periodic timer events and the trigger event. Because the absolute value of that internal offset is unknown, we will just call that the accumulated offset. Whenever the Offset parameter is changed, you are changing that accumulated offset. You can reset the displayed offset using Reset Offset Display. Changing the display does not change the value of the accumulated offset, and you can still make additional changes to accumulated offset.

To avoid ambiguity, we define that an increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.

Key Path	**Trigger, Periodic Timer**
Remote Command	`:TRIGger[:SEQuence]:FRAMe:OFFSet <time>` `:TRIGger[:SEQuence]:FRAMe:OFFSet?`
Example	TRIG:FRAM:OFFS 1.2 ms

Notes	The front panel interface (for example, the knob), and this command, adjust the accumulated offset, which is shown on the active function display. However, the actual amount sent to the hardware each time the offset is updated is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value. Note that the accumulated offset value is essentially arbitrary; it represents the accumulated offset from the last time the offset was zeroed (with the Reset Offset Display key). Note that this command does not change the period of the trigger waveform. Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see section “Trig Delay” on page 320. An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.
Notes	When the SCPI command is sent the value shown on the key (and the Active Function, if this happens to be the active function) is updated with the new value. However, the actual amount sent to the hardware is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value. The SCPI query simply returns the value currently showing on the key.
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes.
Couplings	The same offset is used in the Gate Source selection of the period timer.
Preset	0 s
State Saved	Saved in instrument state
Min	–10.000 s
Max	10.000 s
Default Unit	S
Initial S/W Revision	Prior to A.02.00

Offset Adjust (Remote Command Only)

This remote command does not work at all like the related front panel keys. This command lets you advance the phase of the frame trigger by the amount you specify.

It does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger an additional amount each time it is sent. Negative numbers are permitted.

Remote Command:	`:TRIGger[:SEQuence]:FRAMe:ADJust <time>`
Example:	TRIG:FRAM:ADJ 1.2 ms
Notes:	Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see section “Trig Delay” on page 320 An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.

Notes:	The front panel interface (for example, the knob) and the :TRIG:FRAM:OFFS command adjust the accumulated offset, which is shown on the active function display. However, the actual amount sent to the hardware is the delta value, that is, the current offset value minus the previous offset value. When the SCPI command is sent the value shown on the key (and the Active Function, if this happens to be the active function) is updated by increasing it (or decreasing it if the value sent is negative) by the amount specified in the SCPI command. This is a "command only" SCPI command, with no query.
Dependencies:	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes.
Couplings:	The same offset is used in the Gate Source selection of the period timer.
Preset:	0 s
State Saved:	Saved in instrument state
Min:	–10.000 s
Max:	10.000 s
Default Unit:	S
Initial S/W Revision:	Prior to A.02.00

Reset Offset Display

Resets the value of the periodic trigger offset display setting to 0.0 seconds. The current displayed trigger location may include an offset value defined with the **Offset** key. Pressing this key redefines the currently displayed trigger location as the new trigger point that is 0.0 s offset. The **Offset** key can then be used to add offset relative to this new timing.

Key Path	**Trigger, Periodic Timer**
Remote Command	`:TRIGger[:SEQuence]:FRAMe:OFFSet:DISPlay:RESet`
Example	TRIG:FRAM:OFFS:DISP:RES
Initial S/W Revision	Prior to A.02.00

Sync Source

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you are triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

For convenience you may adjust the level and slope of the selected sync source in a conditional branch setup menu accessed from the Sync Source menu. Note that these settings match those in the **Trigger** and **Gate Source** menus; that is, each trigger source has only one value of level and slope, regardless of which menu it is accessed from.

Key Path	**Trigger, Periodic Timer**

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1|EXTernal2|RFBurst|OFF` `:TRIGger[:SEQuence]:FRAMe:SYNC?`
Example	TRIG:FRAM:SYNC EXT2
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a "Hardware missing; Not available for this model number" error
Preset	Off GSM/EDGE: RFBurst
State Saved	Saved in instrument state
Readback	The current setting is read back to this key and it is also Readback to the previous **Periodic Timer** trigger key.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Off

Turns off the sync source for your periodic trigger. With the sync source off, the timing will drift unless the signal source frequency is locked to the analyzer frequency reference.

Key Path	**Trigger, Periodic Timer, Sync Source**
Example	TRIG:FRAM:SYNC OFF
Readback	Off
Initial S/W Revision	Prior to A.02.00

External 1

Pressing this key, when it is not selected, selects the external input port that you will use for the periodic trigger synchronization. Pressing this key, when it is already selected, accesses the external 1 sync source setup menu.

Key Path	**Trigger, Periodic Timer, Sync Source**
Example	TRIG:FRAM:SYNC EXT
Couplings	Same as External 1 trigger source.
Readback	External 1
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets the value where the signal at the external 1 trigger input will synchronize with the periodic timer trigger. This same level is used in the Ext1 trigger source in the Trigger menu. See section "Trigger Level " on page 304 for information on this key and the SCPI command.

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge. This same value is used in the Ext1 trigger source in the Trigger menu. See section "Trig Slope " on page 305 for information on this key and the SCPI command

External 2

Pressing this key, when it is not selected, selects the external input port that you will use for the periodic frame trigger synchronization.

Pressing this key, when it is already selected, accesses the external 2 sync source setup menu.

Key Path	**Trigger, Periodic Timer, Sync Source**
Example	TRIG:FRAM:SYNC EXT2
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a "Hardware missing; Not available for this model number" error
Couplings	Same as External 2 trigger source.
Readback	External 2
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

Trigger Level

Sets the value where the signal at the external 2 trigger input will synchronize with the periodic timer trigger. This same level is used in the Ext2 trigger source in the Trigger menu. See section "Trigger Level " on page 307 for information on this key and the SCPI command.

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge. This same value is used in the Ext2 trigger source in the Trigger menu. See section "Trig Slope " on page 307 for information on this key and the SCPI command

RF Burst

Pressing the key once selects the RF burst envelope signal to be used for the periodic timer trigger synchronization.

Press the key a second time to access the RF burst sync source setup menu.

Key Path	**Trigger, Periodic Timer, Sync Source**
Example	TRIG:FRAM:SYNC RFB
Couplings	Same as RF Burst trigger source.
Readback	RF Burst
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets the trigger level to be used for the RF Burst trigger. This same level is used in the RF Burst trigger source in the Trigger menu. See section “Absolute Trigger Level” on page 309for information on this key and the SCPI command.

Trig Slope

Controls the RF Burst trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge. This same value is used in the RF Burst trigger source in the Trigger menu. See section “Trigger Slope ” on page 312 for information on this key and the SCPI command

Trig Delay

This setting delays the measurement timing relative to the Periodic Timer.

Key Path	**Trigger, Periodic Timer**

Remote Command	`:TRIGger[:SEQuence]:FRAMe:DELay <time>`
	`:TRIGger[:SEQuence]:FRAMe:DELay?`
	`:TRIGger[:SEQuence]:FRAMe:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:FRAMe:DELay:STATe?`

Notes	Note that delay is used when the sync source is not set to OFF. If the sync source is set to OFF, offset is used, see section 5.3.7.2.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	–150 ms
Max	+500 ms
Default Unit	s
Initial S/W Revision	Prior to A.02.00

Sync Holdoff

Sync Holdoff specifies the duration that the sync source signal must be kept false before the transition to true to be recognized as the sync timing. The periodic timer phase is aligned when the sync source signal becomes true, after the Holdoff time is satisfied.

A holdoff of 2 ms will work with most WiMAX signals, but there may be cases where the burst off duration is less than 1 ms and this value will need to be changed.

Key Path	**Trigger, Periodic Timer**

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff <time>`
	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff?`
	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe?`

Preset	On, 1.000 ms
State Saved	Saved in instrument state

Min	0 ms
Max	+500 ms
Default Unit	s
Initial S/W Revision	Prior to A.02.00

LXI Trigger

Pressing this key when it is not selected selects the LXI system as the trigger. Pressing the key when it is already selected accesses the LXI trigger type selection menu, where either LAN Event or Alarm can be chosen. The key is annotated to display which of the two is currently selected.

NOTE For information about setting up measurements using LXI, refer to the Programmer's Guide located in your analyzer at: C:/Program Files/Agilent/Signal Analysis/Help/Bookfiles/x_series_prog.pdf. It is also available by selecting the "Additional Documentation" page of the Help.

Key Path	**Trigger**
Preset	ON
State Saved	Saved in instrument state
Readback	The LXI trigger source that becomes active when this key is selected is displayed. The possible values are "LAN Event" and "Alarm"
Initial S/W Revision	Prior to A.02.00

LAN Event

Pressing this key when it is not selected selects the LAN event system as the LXI trigger. A new sweep/measurement starts when the pre-configured LAN message arrives if the LXI trigger is selected (see "LXI Trigger" on page 321). Pressing this key when it is already selected accesses the LAN trigger setup menu.

NOTE Pressing this key causes Enabled LXI Alarm Triggers to be ignored, since the Trigger source is changed to LXI LAN Event.

Key Path	**Trigger, LXI Trigger**
Example	TRIG:SOUR LAN ! Swept SA measurement TRIG:<meas>:SOUR LAN ! Measurements other than Swept SA
Preset	ON
State Saved	Saved in instrument state

Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00

Disable All

Sets the Enable parameter of every member of the LXI LAN Event list to OFF.

Key Path	**Trigger, LXI Trigger, LAN Event**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN:DISable:ALL`
Example	:TRIG:LXI:LAN:DIS:ALL
Initial S/W Revision	Prior to A.02.00

LAN Event List

After selecting LAN as the trigger source, the user is presented with a list of LXI Trigger LAN Events to be configured. By default, LAN0-LAN7 are available. Using the TRIG:LXI:LAN:ADD and TRIG:LXI:LAN:REM commands, the size of this list can be changed arbitrarily. Pressing a LAN event branches to that event’s setup menu.

Key Path	**Trigger, LXI Trigger, LAN Event**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN:LIST?`
Example	:TRIG:LXI:LAN:LIST? !Returns the complete list of Trigger LAN Events which is, at minimum: "LAN0", "LAN1", "LAN2", "LAN3", "LAN4", "LAN5", "LAN6", "LAN7"
Preset	"LAN0", "LAN1", "LAN2", "LAN3", "LAN4", "LAN5", "LAN6", "LAN7"
State Saved	Saved in instrument state
Readback	Displays the value of the LXI Trigger LAN Event parameter (Enabled|Disabled).
Initial S/W Revision	Prior to A.02.00

Detection

Pressing this key accesses the Trigger Detection menu.

Selecting "Rise" causes the instrument to trigger on the receipt of a signal low LAN Event followed by a signal high LAN Event.

Selecting "Fall" caused the instrument to trigger on the receipt of a signal high LAN Event followed by a signal low LAN Event.

Selecting "High" causes the instrument to trigger on every signal high LAN Event.

Selecting "Low" causes the instrument to trigger on every signal low LAN Event.

Key Path	**Trigger, LXI Trigger, LAN Event, <lanEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:DETection "LANEVENT", HIGH|LOW|RISE|FALL`
Example	:TRIG:LXI:LAN:DET "LAN0",HIGH
Notes	If a non existent LAN event is passed in the lanEvent argument, the command is ignored
Preset	HIGH
State Saved	Saved in instrument state
Range	HIGH | LOW | RISE | FALL
Readback	Currently selected detection type
Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, LAN Event, <lanEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:DETection? "LANEVENT"`
Example	:TRIG:LXI:LAN:DET? "LAN0"?
Notes	If a non existent LAN event is passed in the lanEvent argument, the command is ignored
Preset	HIGH
State Saved	Saved in instrument state
Range	HIGH | LOW | RISE | FALL
Readback	Currently selected detection type
Initial S/W Revision	Prior to A.02.00

Delay

Sets the amount of delay that should pass between receiving a LXI Trigger LAN Event Trigger and the trigger action. A Delay of 0.0 s indicates that the instrument will trigger as soon as possible after receiving the proper LXI LAN Event.

Key Path	**Trigger, LXI Trigger, LAN Event, <lanEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:DELay "LANEVENT",<time>`
Example	:TRIG:LXI:LAN:DEL "LAN0",5S
Preset	0.0 s
State Saved	Saved in instrument state
Range	0.0 – 1.7976931348623157 x 10308 (Max Double)

Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, LAN Event, <lanEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:DELay? "lanEvent"`
Example	:TRIG:LXI:LAN:DEL? "LAN0"
Preset	0.0 s
State Saved	Saved in instrument state
Range	0.0 – 1.7976931348623157 x 10308 (Max Double)
Initial S/W Revision	Prior to A.02.00

Enabled/Disabled

When the Trigger Source is set to LXI Trigger LAN Event, the instrument triggers upon receiving any event from the LXI Trigger LAN Event List whose Enabled parameter is set to ON.

If the Enabled parameter is set to OFF, the event is ignored.

Key Path	**Trigger, LXI Trigger, LAN Event, <lanEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:ENABled "LANEVENT",ON|OFF|1|0`
Example	:TRIG:LXI:LAN:ENAB "LAN0",ON
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON|0|1
Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, LAN Event, <lanEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:ENABled? "LANEVENT"`
Example	:TRIG:LXI:LAN:ENAB? "LAN0"
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON|0|1
Initial S/W Revision	Prior to A.02.00

Add (Remote Command Only)

Adds the provided string to the list of possible LAN events to trigger on. As new LAN events are added, keys are generated in the LAN source menu. New key panels are generated as the number of possible LAN events increases past a multiple of six, and the "More" keys are updated to reflect the new number of key panels in the LAN source menu.

Remote Command:	`:TRIGger[:SEQuence]:LXI:LAN:ADD "LANEVENT"`
Example:	:TRIG:LXI:LAN:ADD "LANEVENT"
Notes:	The maximum length of the string is 16 characters. Longer strings are concatenated to 16 characters and added. No event is added if the LAN Event already exists. This command modifies the LXI Trigger LAN Event List Parameter.
State Saved:	Saved in instrument state
Range:	Uppercase, Lowercase, Numeric, Symbol except for comma or semicolon
Initial S/W Revision:	Prior to A.02.00

Remove (Remote Command Only)

Removes the provided string from the list of possible LAN events to trigger on. As LAN events are removed, keys are removed from the LAN source menu. Key panels are removed as the number of possible LAN events decreases past a multiple of six, and the "More" keys are updated to reflect the new number of key panels in the LAN source menu. It is not possible to remove the "LAN0" – "LAN7" events.

Remote Command:	`:TRIGger[:SEQuence]:LXI:LAN:REMove[:EVENt] "LANEVENT"`
Example:	:TRIG:LXI:LAN:REM "LANEVENT"
Notes:	The maximum length of the string is 16 characters. Longer strings are concatenated and the corresponding LAN Event is removed. Nothing happens if the LAN event does not exist. This command modifies the LXI Trigger LAN Event List Parameter.
State Saved:	No
Range:	Uppercase, Lowercase, Numeric, Symbol except for comma or semicolon
Initial S/W Revision:	Prior to A.02.00

Remove All (Remote Command Only)

Clears the list of customer added LAN events that can cause the instrument to trigger. Events LAN0-LAN7 are not affected. As LAN events are removed, keys are removed from the LAN source menu. Key panels are removed as the number of possible LAN events decreases past a multiple of six, and the "More" keys are updated to reflect the new number of key panels in the LAN source menu.

It is not possible to remove the "LAN0" – "LAN7" events.

Remote Command:	`:TRIGger[:SEQuence]:LXI:LAN:REMove:ALL`
Example:	:TRIG:LXI:LAN:REM:ALL

Notes:	This command modifies the LXI Trigger LAN Event List Parameter.
Initial S/W Revision:	Prior to A.02.00

Event Filter (Remote Command Only)

Only LXI Trigger LAN Events coming from hosts matching the filter string are processed. There is no front panel access to this command

The syntax for specifying a filter is as follows:

Filter == ([host[:port]] | [ALL[:port]]) [,Filter]

Specifying an empty string means that LXI trigger packets are accepted as a Trigger from any port on any host on the network via either TCP or UDP.

Specifying only the port means that any host communicating over that port can send events.

Specifying ALL indicates that UDP multicast packets are accepted if they are directed to the Internet Assigned Numbers Authority (IANA) assigned multicast address on the IANA assigned default port, or the designated port if specified.

Examples:

"192.168.0.1:23"

"agilent.com, soco.agilent.com"

"agilent.com:80, 192.168.0.1"

- The TRIGger:LXI:LAN:FILTer command applies only to trigger events and will have no effect on state events, even when both are tied to the same event name (like "LAN0"). Similarly, the LXI:EVENt:INPut:LAN:FILTer command applies only to state events and will have no effect on trigger events.

Remote Command:	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:FILTer "LANEVENT","filterString"` `:TRIGger[:SEQuence]:LXI:LAN[:SET]:FILTer?`
Example:	:TRIG:LXI:LAN:FILT "LAN0","agilent.com" :TRIG:LXI:LAN:FILT?
Notes:	The maximum length of the string is 45 characters. Nothing happens if the LAN event does not exist.
Preset:	“” (empty string)
State Saved:	Saved in instrument state
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Count (Remote Command Only)

Returns the number of items in the LXI Trigger LAN Event List.

Remote Command:	`:TRIGger[:SEQuence]:LXI:LAN:COUNt?`

Example:	:TRIG:LXI:LAN:COUN?
Initial S/W Revision:	Prior to A.02.00

Identifier (Remote Command Only)

Sets the string that is expected to arrive over the LAN for a given Trigger LAN Event to occur. The Identifier is variable to allow for easier system debugging.

Remote Command:	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:IDENtifier "LANEVENT","identifier"` `:TRIGger[:SEQuence]:LXI:LAN[:SET]:IDENtifier? "LANEVENT"`
Example:	:TRIG:LXI:LAN:IDEN "LAN0","debugstring"
Notes:	The maximum length of the string is 16 characters. Nothing happens if the LAN event does not exist. The default value is that the identifier is equivalent to the name of the LAN Event.
State Saved:	Saved in instrument state
Range:	Uppercase, Lowercase, Numeric, Symbol
Initial S/W Revision:	Prior to A.02.00

Configure (Remote Command Only)

Allows the configuration of some of the above parameters from a single SCPI command.

Remote Command:	`:TRIGger[:SEQuence]:LXI:LAN[:SET]:CONFigure "lanEvent", <enable>, <detection>, <delay>,<filter>,<identifier>`
Example:	:TRIG:LXI:LAN:CONF "LAN0",1,FALL,0.0,"ALL","debugIdentifier"
Initial S/W Revision:	Prior to A.02.00

Alarm

Pressing this key when it is not selected selects the alarm system as the LXI trigger. A new sweep/measurement starts when the configured IEEE 1588 time occurs if the LXI trigger is selected as the active trigger (see “LXI Trigger” on page 321). Pressing this key when it is already selected accesses the alarm source selection menu.

Key Path	**Trigger, LXI Trigger**
Example	TRIG:ACP:SOUR ALAR
Preset	ON
State Saved	Saved in instrument state

Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears.
Initial S/W Revision	Prior to A.02.00

Disable All

This key causes all Alarms in the trigger alarm list to go into the disabled state.

(Enabled = OFF)

Key Path	**Trigger, LXI Trigger, Alarm**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm:DISable:ALL`
Example	:TRIG:LXI:ALAR:DIS:ALL
Initial S/W Revision	Prior to A.02.00

Alarm List

After selecting Alarm as the trigger source, the user is presented with a list of possible alarms. Pressing an alarm (for example,. "ALARM0") branches to the alarm setup menu.

Key Path	**Trigger, LXI Trigger, Alarm**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm:LIST?`
Example	:TRIG:LXI:ALAR:LIST? Returns the complete list of Alarm events which is: "ALARM0"
Preset	"ALARM0"
State Saved	Saved in instrument state
Readback	Displays the value of the LXI Trigger Alarm Enabled parameter (Enabled|Disabled).
Initial S/W Revision	Prior to A.02.00

Date/Time

Absolute alarm time sets an alarm for one specific time using the date and time of day (for example, 12/14/2007 at 11:45:15.3456). The Date and Time are represented in the instrument's local time. This is the only way to set an alarm from the front panel.

Epoch time is another type of absolute alarm time. A specific time is identified by the number of seconds it occurs after January 1, 1970 00:00:00 in International Atomic Time (TAI). Epoch Time is time zone invariant. Epoch time is only set via remote; see "Epoch Time Value (Remote Command Only)" on page 331.

The date and time the alarm is scheduled to go off is noted on the branch softkey.

NOTE	The Epoch Time Second and Epoch Time Fraction are the ultimate source of alarm information. The Absolute Time and Date may be changed from the front panel without being applied. When querying the Absolute Time and Date parameters from SCPI, if the Absolute Time and Date have not been applied (and therefore do not match the Epoch Time Second and Epoch Time Fraction), the string "(epoch time not set)" is added to the return value.

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>**
Readback	Annotated with the date and time the alarm is scheduled to go off.
Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>,Time**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue]:ABSolute "alarmEvent","date","time"`
Example	:TRIG:LXI:ALAR:TIME:ABS "ALARM0","2007/4/6", "15:45:02.123456"
Notes	"date" is a representation of the date the alarm should occur in the form of "YYYY/MM/DD" where: YYYY is the four digit representation of year. (for example, 2007) MM is the two digit representation of month. (for example. 01 to 12) DD is the two digit representation of day. (for example, 01 to 28, 29, 30, or 31 depending on the month and year) "time" is a representation of the time of day the alarm should occur in the form of "HH:MM:SS.SSSSSS" where: HH is the two digit representation of the hour in 24 hour format MM is the two digit representation of minute SS.SSSSSS is a real representing seconds (for example 02.123456)
Preset	Current date at initialization at 00:00:00.000000
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>,Time**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue]:ABSolute? "alarmEvent"`

Example	:TRIG:LXI:ALAR:TIME:ABS? "ALARM0" This query returns data using the following format "YYYY/MM/DD HH:MM:SS.SSSSSS" If the Absolute time has been changed from the front panel, but has not been applied, the return value is of the form "YYYY/MM/DD HH:MM:SS.SSSSSS (epoch time not set)".
Notes	<date> is a representation of the date the alarm should occur in the form of YYYY/MM/DD where: YYYY is the four digit representation of year. (for example, 2007) MM is the two digit representation of month. (for example. 01 to 12) DD is the two digit representation of day. (for example, 01 to 28, 29, 30, or 31 depending on the month and year) <time> is a representation of the time of day the alarm should occur in the form of HH:MM:SS.SSSSSS where: HH is the two digit representation of the hour in 24 hour format MM is the two digit representation of minute SS.SSSSSS is a real representing seconds (for example 02.123456)
Preset	Current date at initialization at 00:00:00.000000
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Date

The date the alarm should occur. All absolute alarm time parameters are set using the same SCPI command; however they each have their own front panel control.

When setting alarm values from the front panel, the new alarm time is not registered with the alarm system until the "Set" key is pressed.

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>,Time**
Preset	Current date
State Saved	Saved in instrument state
Range	current date – 214748/12/31. Values representing a time in the past result in an error.
Initial S/W Revision	Prior to A.02.00

Time

The time of the day, in the instrument’s local time (this takes into account time zones and daylight savings time), the alarm should occur. This parameter is based on a 24 hour clock.

All absolute alarm time parameters are set using the same SCPI command; however they each have their own front panel control.

When setting alarm values from the front panel, the new alarm time is not registered with the alarm system until the

"Set" key is pressed.

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>,Time**
Notes	Uses a 24 hour clock. Values representing a time in the past result in an error. Only valid time values are accepted. The <second> field accepts a decimal number, and is valid to the microsecond position. The <year>, <month>, <hour>, and <minute> fields all accept integers.
Preset	00:00:00.000000
State Saved	Saved in instrument state
Range	00:00:00.000000 – 23:59:59.999999
Initial S/W Revision	Prior to A.02.00

Apply

Causes the Absolute Alarm Time values to be converted into an Epoch time (see "Epoch Time Value (Remote Command Only)" on page 331), compared to the current time, and sent to the Alarm Trigger subsystem. This key can only be pressed when the epoch time and the absolute time are out of synch.

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>,Time**
Notes	Alarm times are settable to microsecond resolution.
Initial S/W Revision	Prior to A.02.00

Epoch Time Value (Remote Command Only)

Sets the LXI Alarm Time. This represents the number of seconds after January 1, 1970 00:00:00, in TAI time, that the alarm should go off.

Remote Command:	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue] "alarmEvent",<seconds>, <fractionalSeconds>`
Example:	:TRIG:LXI:ALAR:TIME "ALARM0",123456.0 S, 0.123456
Notes:	Values representing a time in the past result in an error.
Preset:	Seconds: The number of whole seconds between Jan 1, 1970 at 00:00:00 (in TAI time) and the current date at initialization at 00:00:00 (in TAI time) FractionalSeconds: 0
State Saved:	Saved in instrument state
Range:	Seconds: Epoch time of current date at 00:00:00 (in TAI time) – 253402300800 + number of seconds local time zone offset from UTC FractionalSeconds: 0.0 – 0.999999
Initial S/W Revision:	Prior to A.02.00

Remote Command:	:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue]?
Example:	:TRIG:LXI:ALAR:TIME?
Notes:	Values representing a time in the past result in an error.
Preset:	Seconds: The number of whole seconds between Jan 1, 1970 at 00:00:00 (in TAI time) and the current date at initialization at 00:00:00 (in TAI time) FractionalSeconds: 0
State Saved:	Saved in instrument state
Range:	Seconds: Epoch time of current date at 00:00:00 (in TAI time) – 253402300800 + number of seconds local time zone offset from UTC FractionalSeconds: 0.0 – 0.999999
Initial S/W Revision:	Prior to A.02.00

Epoch Time Seconds (Remote Command Only)

Sets the seconds portion of the LXI Alarm time. This represents the number of seconds after January 1, 1970 00:00:00 (in TAI time) that the alarm should go off.

Values must be in the form of whole seconds; decimal values result in an error.

Remote Command:	:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME:SEConds "alarmEvent",<seconds>
Example:	:TRIG:LXI:ALAR:TIME:SEC "ALARM0",123456.0 S
Notes:	Values representing a time in the past result in an error. Values containing a decimal portion result in an error.
Preset:	The number of whole seconds between Jan 1, 1970 at 00:00:00 (in TAI time) and the current date at initialization at 00:00:00 (in TAI time)
State Saved:	Saved in instrument state
Range:	Epoch time of current date at 00:00:00 (in TAI time) – 253402300800 + number of seconds local time zone offset from UTC
Initial S/W Revision:	Prior to A.02.00

Remote Command:	:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME:SEConds? "alarmEvent"
Example:	:TRIG:LXI:ALAR:TIME:SEC "ALARM0"?
Notes:	Values representing a time in the past result in an error. Values containing a decimal portion result in an error.
Preset:	The number of seconds between Jan 1, 1970 at 00:00:00 (in TAI time) and the current date at initialization at 00:00:00 (in TAI time)
State Saved:	Saved in instrument state

Range:	Epoch time of current date at 00:00:00 (in TAI time) – 253402300800 + number of seconds local time zone offset from UTC
Initial S/W Revision:	Prior to A.02.00

Epoch Time Fraction (Remote Command Only)

Sets the sub-second value of the Epoch time.

Remote Command:	:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue]:FRACtion "alarmEvent",<fractionalSeconds>
Example:	:TRIG:LXI:ALAR:TIME:FRAC "ALARM0",0.123456 S
Notes:	Values representing a time in the past result in an error.
Preset:	0
State Saved:	Saved in instrument state
Range:	0.0 – 0.999999
Initial S/W Revision:	Prior to A.02.00

Remote Command:	:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue]:FRACtion? "alarmEvent"
Example:	:TRIG:LXI:ALAR:TIME:FRAC "ALARM0"?
Notes:	Values representing a time in the past result in an error.
Preset:	0
State Saved:	Saved in instrument state
Min:	0.0
Max:	0.999999
Initial S/W Revision:	Prior to A.02.00

Relative Time (Remote Command Only)

Sets the values of Epoch Time Seconds and Epoch Time Fraction by adding an offset to the time when the command is issued. For example, if the Relative Time command is issued with an argument of 60s, the alarm will occur 1 minute in the future.

Remote Command:	:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue]:RELative "alarmEvent",<seconds>
Example:	:TRIG:LXI:ALAR:TIME:REL "ALARM0",60.0s
Range:	0.0 – 1.7976931348623157 x 10308 (Max Double)
Initial S/W Revision:	Prior to A.02.00

Remote Command:	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:TIME[:VALue]:RELative? "alarmEvent"`
Example:	:TRIG:LXI:ALAR:TIME:REL "ALARM0"?
Range:	0.0 – 1.7976931348623157 x 10308 (Max Double)
Initial S/W Revision:	Prior to A.02.00

Period

Sets the amount of time that should elapse between alarms in a repeating alarm trigger.

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:PERiod "alarmEvent",<seconds>`
Example	:TRIG:LXI:ALAR:PER "ALARM0",1.2345 s
Notes	A period of 0.0s effectively causes the trigger to occur only once, since all repetitions are fired simultaneously
Preset	0.0 s
State Saved	Saved in instrument state
Range	0.0 – 1.7976931348623157 x 10308 (Max Double)
Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:PERiod? "alarmEvent"`
Example	:TRIG:LXI:ALAR:PER "ALARM0"?
Notes	A period of 0.0s effectively causes the trigger to occur only once, since all repetitions are fired simultaneously
Preset	0.0 s
State Saved	Saved in instrument state
Range	0.0 – 1.7976931348623157 x 10308 (Max Double)
Initial S/W Revision	Prior to A.02.00

Repetitions

Sets the number of times a repeating alarm should fire once the initial alarm time has occurred.

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:REPeat "alarmEvent",<repetitions>`

Example	:TRIG:LXI:ALAR:REP "ALARM0",10
Notes	A repetition value of 0 means infinite repetitions (zero is a special case, triggers at the given period indefinitely) A repetition value of 1 means 1 trigger only, not the intial trigger + 1 repeat
Preset	1
State Saved	Saved in instrument state
Range	1 – 2,147,483,647
Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:REPeat? "alarmEvent"`
Example	:TRIG:LXI:ALAR:REP "ALARM0",10
Preset	1
State Saved	Saved in instrument state
Min	1
Max	2,147,483,647
Initial S/W Revision	Prior to A.02.00

Enabled

If Enabled is set to ON and the trigger source is set to ALARm, this alarm causes the instrument to trigger.

If Enabled is set to OFF, this alarm is ignored

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:ENABled "alarmEvent",ON|OFF|1|0`
Example	:TRIG:LXI:ALAR:ENAB "ALARM0",ON
Preset	OFF
State Saved	Saved in instrument state
Range	1|0
Initial S/W Revision	Prior to A.02.00

Key Path	**Trigger, LXI Trigger, Alarm, <alarmEvent>**
Remote Command	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:ENABled? "alarmEvent"`
Example	:TRIG:LXI:ALAR:ENAB "ALARM0"?

Preset	OFF
State Saved	Saved in instrument state
Range	1|0
Initial S/W Revision	Prior to A.02.00

Configure (Remote Command Only)

Allows the configuration of some of the above parameters from a single SCPI command.

Remote Command:	`:TRIGger[:SEQuence]:LXI:ALARm[:SET]:CONFigure "alarmEvent", <enable>, <epochSeconds>, <epochFraction>, <period>, <repeat>`
Example:	:TRIG:LXI:ALAR:CONF "ALARM0",1,1000000.0,0.123456,1.2,3
Initial S/W Revision:	Prior to A.02.00

Count (Remote Command Only)

Returns the number of alarms in the LXI Trigger Alarm List.

Remote Command:	`:TRIGger1|TRIGger[:SEQuence]:LXI:ALARm:COUNt?`
Example:	:TRIG:LXI:ALAR:COUN?
Initial S/W Revision:	Prior to A.02.00

Baseband I/Q

Pressing this key when it is not selected selects Baseband I/Q as the trigger. Pressing the key when it is already selected accesses the Baseband I/Q trigger type selection menu. The key is annotated to display which of the Baseband I/Q trigger types is currently selected.

Key Path	**Trigger**
State Saved	Saved in instrument state
Readback	The Baseband I/Q trigger source that becomes active when this key is selected is displayed. The possible values are "I/Q Mag", "I", "Q", "Input I", "Input Q", and "Aux I/Q Mag".
Initial S/W Revision	Prior to A.02.00

I/Q Mag

Pressing this key, when it is not selected, selects the I/Q magnitude signal as the trigger. The I/Q Magnitude trigger condition is met when the I/Q magnitude crosses the I/Q magnitude trigger level. The magnitude is measured at the output of the main I/Q digital receiver.

Key Path	**Trigger, Baseband I/Q**
Example	TRIG:<meas>:SOUR IQM

Readback Text	I/Q Mag
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets a level for the I/Q magnitude trigger. When the signal crosses this level, with the chosen slope, the trigger occurs. If the specific Measurement displays the signal from the chosen sampling point a green line will be displayed to indicate the trigger level.

Key Path	**Trigger, Baseband I/Q, I/Q Mag**
Remote Command	`:TRIGger[:SEQuence]:IQMag:LEVel <ampl >` `:TRIGger[:SEQuence]:IQMag:LEVel?`
Example	TRIG:IQM:LEV –30 dBm
Notes	The I/Q reference impedance is used for converting between power and voltage.
Preset	–25 dBm
State Saved	Saved in instrument state
Range	–200 dBm to 100 dBm
Readback Text	<level> dBm
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Baseband I/Q, I/Q Mag**
Remote Command	`:TRIGger[:SEQuence]:IQMag:SLOPe POSitive | NEGative` `:TRIGger[:SEQuence]:IQMag:SLOPe?`
Example	TRIG:IQM:SLOP POS
Preset	POSitive
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT.

Key Path	**Trigger, Baseband I/Q, I/Q Mag**

Remote Command	`:TRIGger[:SEQuence]:IQMag:DELay <time>`
	`:TRIGger[:SEQuence]:IQMag:DELay?`
	`:TRIGger[:SEQuence]:IQMag:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:IQMag:DELay:STATe?`

Example	TRIG:IQM:DEL 10 ms TRIG:IQM:DEL:STAT ON
Preset	1 us OFF
State Saved	Saved in instrument state
Range	–2.5 s to +10 s
Initial S/W Revision	Prior to A.02.00

I (Demodulated)

Pressing this key, when it is not selected, selects the main receiver's output I voltage as the trigger. The I (Demodulated) trigger condition is met when the I voltage crosses the I voltage trigger level.

Key Path	**Trigger, Baseband I/Q**
Example	TRIG:<meas>:SOUR IDEM
Readback Text	I
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets a level for the I (Demodulated) trigger. When the signal crosses this level, with the chosen slope, the trigger occurs. If the specific Measurement displays the signal from the chosen sampling point a green line will be displayed to indicate the trigger level.

Key Path	**Trigger, Baseband I/Q, I (Demodulated)**
Remote Command	`:TRIGger[:SEQuence]:IDEMod:LEVel <voltage>` `:TRIGger[:SEQuence]:IDEMod:LEVel?`
Example	TRIG:IDEM:LEV 0.5 V
Preset	0.25 V
State Saved	Saved in instrument state
Range	–1 to 1 V
Readback Text	0.1 of displayed unit (V, mV, etc.)
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Baseband I/Q, I (Demodulated)**
Remote Command	`:TRIGger[:SEQuence]:IDEMod:SLOPe POSitive	NEGative` `:TRIGger[:SEQuence]:IDEMod:SLOPe?`
Example	TRIG:IDEM:SLOP POS
Preset	POSitive
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT.

Key Path	**Trigger, Baseband I/Q, I (Demodulated)**

Remote Command	`:TRIGger[:SEQuence]:IDEMod:DELay <time>`
	`:TRIGger[:SEQuence]:IDEMod:DELay?`
	`:TRIGger[:SEQuence]:IDEMod:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:IDEMod:DELay:STATe?`

Example	TRIG:IDEM:DEL 10 ms TRIG:IDEM:DEL:STAT ON
Preset	1 us OFF
State Saved	Saved in instrument state
Range	–2.5 s to +10 s
Initial S/W Revision	Prior to A.02.00

Q (Demodulated)

Pressing this key, when it is not selected, selects the main receiver's output Q voltage as the trigger. The Q (Demodulated) trigger condition is met when the Q voltage crosses the Q voltage trigger level.

Key Path	**Trigger, Baseband I/Q**
Example	TRIG:<meas>:SOUR QDEM
Readback Text	Q
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets a level for the Q (Demodulated) trigger. When the signal crosses this level, with the chosen slope, the trigger occurs. If the specific Measurement displays the signal from the chosen sampling point a green line will be displayed to indicate the trigger level.

Key Path	**Trigger, Baseband I/Q, Q (Demodulated)**
Remote Command	`:TRIGger[:SEQuence]:QDEMod:LEVel <voltage>` `:TRIGger[:SEQuence]:QDEMod:LEVel?`
Example	TRIG:QDEM:LEV 0.5 V
Preset	0.25 V
State Saved	Saved in instrument state
Range	–1 to 1 V
Readback Text	0.1 of displayed unit (V, mV, etc.)
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Baseband I/Q, Q (Demodulated)**
Remote Command	`:TRIGger[:SEQuence]:QDEMod:SLOPe POSitive | NEGative` `:TRIGger[:SEQuence]:QDEMod:SLOPe?`
Example	TRIG:QDEM:SLOP POS
Preset	POSitive
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT.

Key Path	**Trigger, Baseband I/Q, Q (Demodulated)**

Remote Command	`:TRIGger[:SEQuence]:QDEMod:DELay <time>`
	`:TRIGger[:SEQuence]:QDEMod:DELay?`
	`:TRIGger[:SEQuence]:QDEMod:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:QDEMod:DELay:STATe?`

Example	TRIG:QDEM:DEL 10 ms TRIG:QDEM:DEL:STAT ON

Preset	1 us OFF
State Saved	Saved in instrument state
Range	–2.5 s to +10 s
Initial S/W Revision	Prior to A.02.00

Input I

Pressing this key, when it is not selected, selects the I channel's ADC voltage as the trigger. The Input I trigger condition is met when the voltage crosses the trigger level.

Key Path	**Trigger, Baseband I/Q**
Example	TRIG:<meas>:SOUR IINP
Readback Text	Input I
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets a level for the Input I trigger. When the signal crosses this level, with the chosen slope, the trigger occurs.

Key Path	**Trigger, Baseband I/Q, Input I**
Remote Command	`:TRIGger[:SEQuence]:IINPut:LEVel <voltage>` `:TRIGger[:SEQuence]:IINPut:LEVel?`
Example	TRIG:IINP:LEV 0.5 V
Preset	0.25 V
State Saved	Saved in instrument state
Range	–1 to 1 V
Readback Text	0.1 of displayed unit (V, mV, etc.)
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Baseband I/Q, Input I**
Remote Command	`:TRIGger[:SEQuence]:IINPut:SLOPe POSitive | NEGative` `:TRIGger[:SEQuence]:IINPut:SLOPe?`
Example	TRIG:IINP:SLOP POS
Preset	POSitive

State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT.

Key Path	**Trigger, Baseband I/Q, Input I**

Remote Command	`:TRIGger[:SEQuence]:IINPut:DELay <time>`
	`:TRIGger[:SEQuence]:IINPut:DELay?`
	`:TRIGger[:SEQuence]:IINPut:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:IINPut:DELay:STATe?`

Example	TRIG:IINP:DEL 10 ms TRIG:IINP:DEL:STAT ON
Preset	1 us OFF
State Saved	Saved in instrument state
Range	–2.5 s to +10 s
Initial S/W Revision	Prior to A.02.00

Input Q

Pressing this key, when it is not selected, selects the Q channel's ADC voltage as the trigger. The Input Q trigger condition is met when the voltage crosses the trigger level.

Key Path	**Trigger, Baseband I/Q**
Example	TRIG:<meas>:SOUR QINP
Readback Text	Input Q
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets a level for the Input Q trigger. When the signal crosses this level, with the chosen slope, the trigger occurs.

Key Path	**Trigger, Baseband I/Q, Input Q**
Remote Command	`:TRIGger[:SEQuence]:QINPut:LEVel <voltage>` `:TRIGger[:SEQuence]:QINPut:LEVel?`
Example	TRIG:QINP:LEV 0.5 V
Preset	0.25 V

State Saved	Saved in instrument state
Range	–1 to 1 V
Readback Text	0.1 of displayed unit (V, mV, etc.)
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Baseband I/Q, Input Q**
Remote Command	`:TRIGger[:SEQuence]:QINPut:SLOPe POSitive | NEGative` `:TRIGger[:SEQuence]:QINPut:SLOPe?`
Example	TRIG:QINP:SLOP POS
Preset	POSitive
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT.

Key Path	**Trigger, Baseband I/Q, Input Q**

Remote Command	`:TRIGger[:SEQuence]:QINPut:DELay <time>`
	`:TRIGger[:SEQuence]:QINPut:DELay?`
	`:TRIGger[:SEQuence]:QINPut:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:QINPut:DELay:STATe?`

Example	TRIG:QINP:DEL 10 ms TRIG:QINP:DEL:STAT ON
Preset	1 us OFF
State Saved	Saved in instrument state
Range	–2.5 s to +10 s
Initial S/W Revision	Prior to A.02.00

Auxiliary Channel I/Q Mag

Pressing this key, when it is not selected, selects the Auxiliary Channel I/Q magnitude signal as the trigger. The Auxiliary Channel I/Q Magnitude trigger condition is met when the auxiliary receiver's I/Q magnitude output crosses the Auxiliary I/Q magnitude trigger level.

Key Path	**Trigger, Baseband I/Q**
Example	TRIG:<meas>:SOUR AIQM
Readback Text	Aux I/Q Mag
Initial S/W Revision	Prior to A.02.00

Trigger Level

Sets a level for the I/Q magnitude trigger. When the signal crosses this level, with the chosen slope, the trigger occurs.

Key Path	**Trigger, Baseband I/Q, Aux Channel I/Q Mag**
Remote Command	`:TRIGger[:SEQuence]:AIQMag:LEVel <ampl >` `:TRIGger[:SEQuence]:AIQMag:LEVel?`
Example	TRIG:AIQM:LEV –30 dBm
Notes	The I/Q reference impedance is used for converting between power and voltage.
Preset	–25 dBm
State Saved	Saved in instrument state
Range	–200 dBm to 100 dBm
Readback Text	<level> dBm
Initial S/W Revision	Prior to A.02.00

Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	**Trigger, Baseband I/Q, Aux Channel I/Q Mag**
Remote Command	`:TRIGger[:SEQuence]:AIQMag:SLOPe POSitive | NEGative` `:TRIGger[:SEQuence]:AIQMag:SLOPe?`
Example	TRIG:AIQM:SLOP POS
Preset	POSitive
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT.

Key Path	**Trigger, Baseband I/Q, Aux Channel I/Q Mag**

Remote Command	`:TRIGger[:SEQuence]:AIQMag:DELay <time>`
	`:TRIGger[:SEQuence]:AIQMag:DELay?`
	`:TRIGger[:SEQuence]:AIQMag:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:AIQMag:DELay:STATe?`

Example	TRIG:AIQM:DEL 10 ms TRIG:AIQM:DEL:STAT ON
Preset	1 us OFF
State Saved	Saved in instrument state
Range	–2.5 s to +10 s
Initial S/W Revision	Prior to A.02.00

Trigger Center Frequency

This key sets the center frequency to be used by the auxiliary receiver.

Key Path	**Trigger, Baseband I/Q, Aux Channel I/Q Mag**
Remote Command	`:TRIGger[:SEQuence]:AIQMag:CENTer <freq>` `:TRIGger[:SEQuence]:AIQMag:CENTer?`
Example	:TRIG:AIQM:CENT 10 MHz
Notes	Trigger CF + 1/2 Trigger BW < Max Trigger CF – 1/2 Trigger BW > Min
Preset	0 Hz
State Saved	Saved in instrument state
Range	–40 MHz to 40 MHz
Initial S/W Revision	Prior to A.02.00

Trigger Bandwidth

This key sets the information bandwidth used by the auxiliary receiver for the Auxiliary Channel I/Q Magnitude trigger.

Key Path	**Trigger, Baseband I/Q, Aux Channel I/Q Mag**
Remote Command	`:TRIGger[:SEQuence]:AIQMag:BANDwidth <freq>` `:TRIGger[:SEQuence]:AIQMag:BANDwidth?`

Example	:TRIG:AIQM:BAND 8 MHz
Notes	The combined sample rate for the main and auxiliary receivers cannot exceed 100 MSa/sec. The bandwidth available to the Trigger BW is limited to what is available after the main receiver's bandwidth (Info BW, sometimes pre-FFT BW) is set. Because of this limitation, the Max is not always achievable. The combination of Trigger Center Freq and Trigger BW is also limited: Trigger CF + 1/2 Trigger BW < Max Trigger CF – 1/2 Trigger BW > Min
Preset	Bandwidth option dependent: No Opt: 10 MHz Opt B25: 25 MHz Opt S40: 40 MHz
State Saved	Saved in instrument state
Range	10 Hz to Maximum
Initial S/W Revision	Prior to A.02.00

Auto/Holdoff

Opens up a menu that lets you adjust Auto Trigger and Trigger Holdoff parameters

Key Path	**Trigger**
Readback line	Displays a summaryof the Auto Trig and Holdoff settings, in square brackets First line: Auto Off or Auto On Second Line: "Hldf" followed by: • If Holdoff is Off, readback Off • If Holdoff On and Type = Normal, readback value • If Holdoff On and Type = Above, readback value followed by AL • If Holdoff On and Type = Below, readback value followed by BL • If Holdoff Type selection is not supported by the current measurement, Holdoff Type is always Normal
Initial S/W Revision	A.02.00

Auto Trig

Sets the time that the analyzer will wait for the trigger conditions to be met. If they are not met after that much time, then the analyzer is triggered anyway.

Key Path	**Trigger, Auto/Holdoff**

Remote Command	`:TRIGger[:SEQuence]:ATRigger <time>`
	`:TRIGger[:SEQuence]:ATRigger?`
	`:TRIGger[:SEQuence]:ATRigger:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:ATRigger:STATe?`

Example	TRIG:ATR:STAT ON TRIG:ATR 100 ms
Notes	The "time that the analyzer will wait" starts when the analyzer is ready for a trigger, which may be hundreds of ms after the data acquisition for a sweep is done. The "time" ends when the trigger condition is satisfied, not when the delay ends.
Preset	Off, 100 ms
State Saved	Saved in instrument state
Min	1 ms
Max	100 s
Default Unit	s
Initial S/W Revision	Prior to A.02.00

Trig Holdoff

Sets the holdoff time between triggers. When the trigger condition is satisfied, the trigger occurs, the delay begins, and the holdoff time begins. New trigger conditions will be ignored until the holdoff time expires. For a free-running trigger, the holdoff value is the minimum time between triggers.

Key Path	**Trigger, Auto/Holdoff**

Remote Command	`:TRIGger[:SEQuence]:HOLDoff <time>`
	`:TRIGger[:SEQuence]:HOLDoff?`
	`:TRIGger[:SEQuence]:HOLDoff:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:HOLDoff:STATe?`

Example	TRIG:HOLD:STAT ON TRIG:HOLD 100 ms
Preset	Off, 100 ms
State Saved	Saved in instrument state
Min	0 s
Max	0.5 s
Default Unit	s
Initial S/W Revision	Prior to A.02.00

Holdoff Type

Lets you set the Trigger Holdoff Type.

NOTE	Holdoff Type is not supported by all measurements. If the current measurement does not support it, this key will be blank and the Holdoff Type will be Normal. If the Holdoff Type SCPI is sent while in such a measurement, the SCPI will be accepted and the setting remembered, but it will have no effect until a measurement is in force that supports Holdoff Type.

Trigger Holdoff Type functionality:

NORMal

This is the “oscilloscope” type of trigger holdoff, and is the setting when the Holdoff Type key does not appear. In this type of holdoff, no new trigger will be accepted until the holdoff interval has expired after the previous trigger.

ABOVe
If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) and then remains above the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) after having been above the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

BELow
If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) after having been below the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) and then remains below the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

Key Path	**Trigger, Auto/Holdoff**
Remote Command	`:TRIGger[:SEQuence]:HOLDoff:TYPE NORMal|ABOVe|BELow` `:TRIGger[:SEQuence]:HOLDoff:TYPE?`
Example	TRIG:HOLD:TYPE NORM
Preset	All modes but GSM/EDGE: Normal GSM/EDGE: Below
State Saved	Saved in instrument state
Initial S/W Revision	A.02.00

Trigger Offset (Remote Command Only)

ESA Backwards Compatibility command

Remote Command:	`:TRIGger[:SEQuence]:OFFSet <time>`
	`:TRIGger[:SEQuence]:OFFSet?`
	`:TRIGger[:SEQuence]:OFFSet:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:OFFSet:STATe?`

Example:	TRIG:OFFS ON TRIG:OFFS –100 ms
Notes:	These are ESA commands for trigger offset that allowed you to use a positive or negative delay when in zero span and in a Res BW >= 1 kHz. For ESA compatibility, X-series analyzers keep track of this offset and add it to the Trigger Delay for line, video or external whenever the value is sent to the hardware, if in Zero Span and RBW >= 1 kHz.
Preset:	Off, 0 s
State Saved:	Saved in instrument state
Min:	–11 s
Max:	+11 s
Initial S/W Revision:	Prior to A.02.00

View/Display

The View/Display key opens up the Display Menu (common to most measurements) and the View menu for the current measurement.

Some measurements have simple View menus, or even no View menu, others provide many different Views.

Views are different ways of looking at data, usually different ways of looking at the same data, especially when the data represents a time record that is being digitally processed with an FFT and/or other digital signal processing algorithms.

Key Path	**Front-panel key**
Initial S/W Revision	Prior to A.02.00

Display

The **Display** menu is common to most measurements, and is used for configuring items on the display. Some **Display** menu settings apply to all the measurements in a mode, and some only to the current measurement. Those under the **System Display Settings** key apply to all measurements in all modes.

Key Path	**Display**

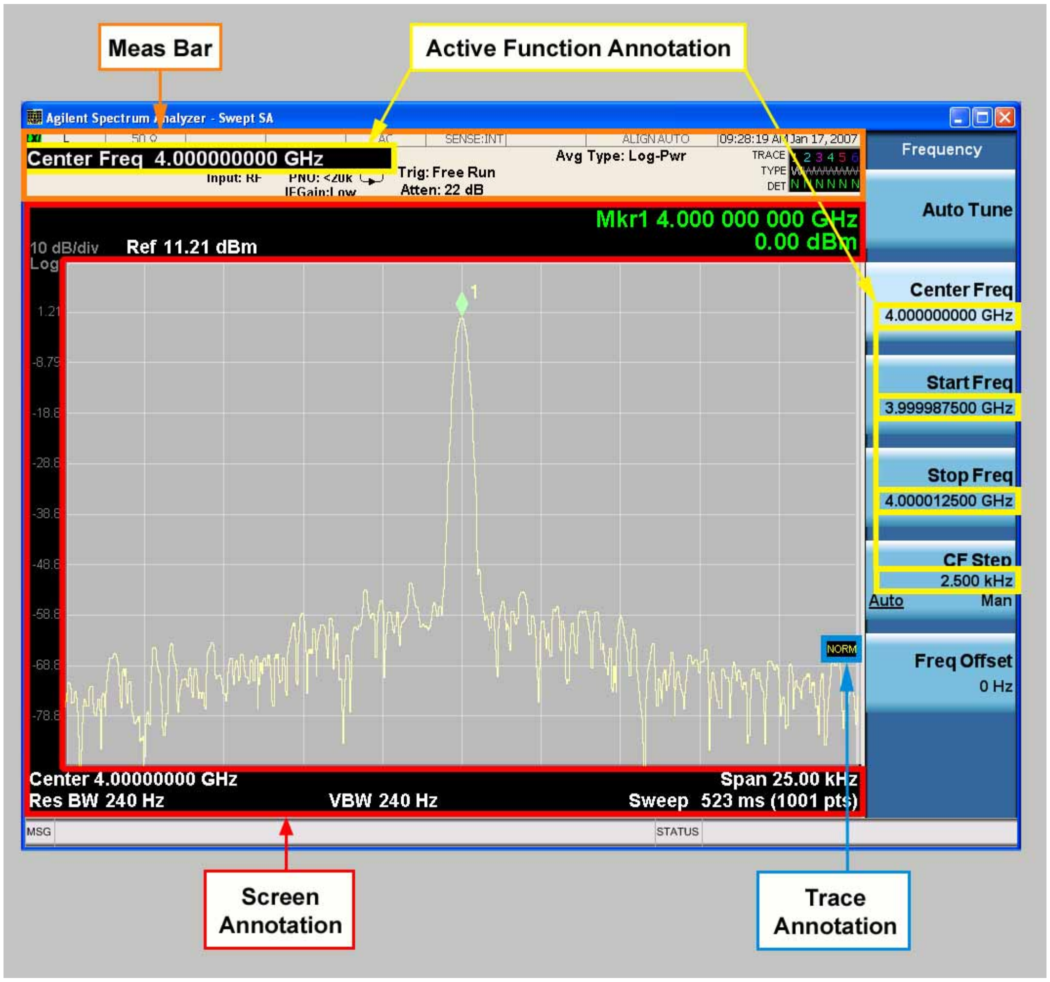
Initial S/W Revision	Prior to A.02.00

Annotation

Turns on and off various parts of the display annotation. The annotation is divided up into four categories:

1. Meas Bar: This is the measurement bar at the top of the screen. It does not include the settings panel or the Active Function. Turning off the Meas Bar turns off the settings panel and the Active Function. When the Meas Bar is off, the graticule area expands to fill the area formerly occupied by the Meas Bar.
2. Screen Annotation: this is the annotation and annunciation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) This does NOT include the marker number or the N dB result. When off, the graticule expands to fill the entire graticule area.
3. Trace annotation: these are the labels on the traces, showing their detector (or their math mode).
4. Active Function annotation: this is the active function display in the meas bar, and all of the active function values displayed on softkeys.

See the figure below. Each type of annotation can be turned on and off individually.



Key Path	**View/Display, Display**
Initial S/W Revision	Prior to A.02.00

Meas Bar On/Off

This function turns the Measurement Bar on and off, including the settings panel. When off, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command:	`:DISPlay:ANNotation:MBAR[:STATe] OFF|ON|0|1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example:	DISP:ANN:MBAR OFF
Dependencies:	Grayed out and forced to OFF when **System Display Settings**, **Annotation** is set to Off.
Preset:	On This should remain Off through a Preset when **System Display Settings**, **Annotation** is set to Off.

State Saved:	Saved in instrument state.
Key Path:	**View/Display, Display, Annotation**
Initial S/W Revision:	Prior to A.02.00

Screen

This controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the y-axis annotation. This does NOT include marker annotation (or the N dB result). When off, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule as described in the Trace/Detector chapter.

Remote Command:	`:DISPlay:ANNotation:SCReen[:STATe] OFF|ON|0|1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example:	DISP:ANN:SCR OFF
Dependencies:	Grayed out and forced to OFF when **System Display Settings**, **Annotation** is set to Off.
Preset:	On This should remain Off through a Preset when **System Display Settings**, **Annotation** is set to Off
State Saved:	Saved in instrument state.
Key Path:	**View/Display, Display, Annotation**
Initial S/W Revision:	Prior to A.02.00

Trace

Turns on and off the labels on the traces, showing their detector (or their math mode) as described in the Trace/Detector section.

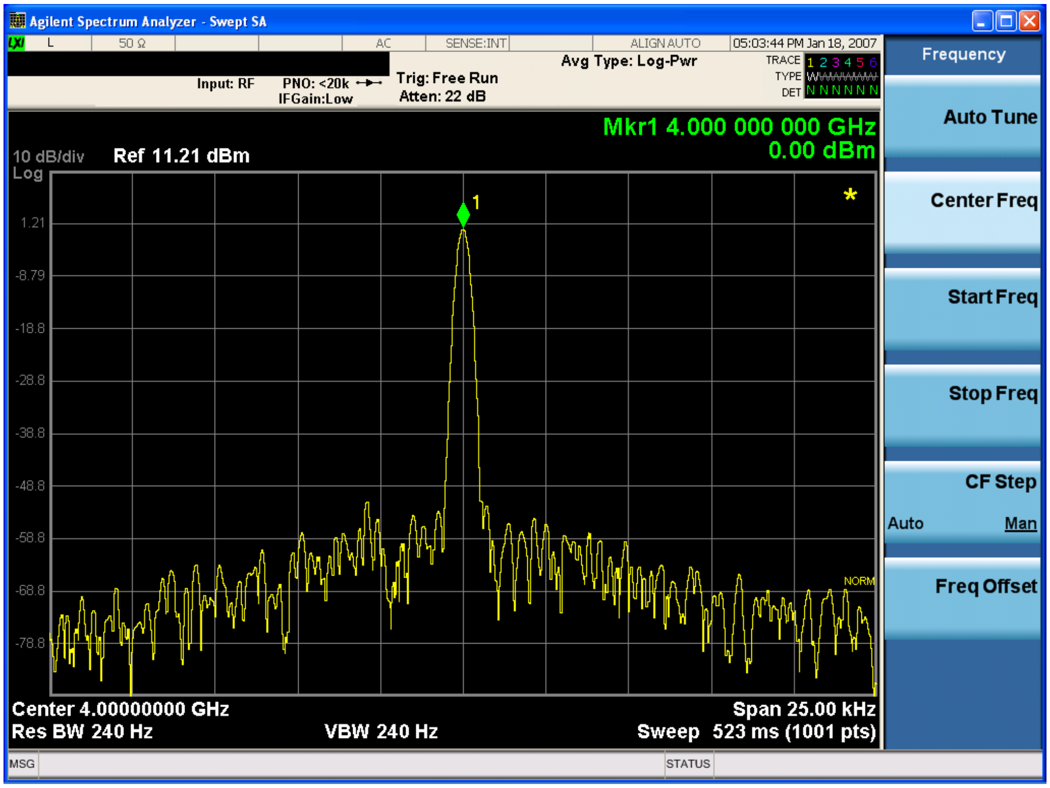
If trace math is being performed with a trace, then the trace math annotation will replace the detector annotation.

Remote Command:	`:DISPlay:ANNotation:TRACe[:STATe] ON|OFF|1|0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example:	DISP:ANN:TRAC OFF
Preset:	Off
State Saved:	Saved in instrument state.
Key Path:	**View/Display, Display, Annotation**
Initial S/W Revision:	Prior to A.02.00

Active Function Values On/Off

Turns on and off the active function display in the Meas Bar, and all of the active function values displayed on the softkeys.

Note that all of the softkeys that have active functions have these numeric values blanked when this function is on. This is a security feature..



Remote Command:	:DISPlay:ACTivefunc[:STATe] ON|OFF|1|0 :DISPlay:ACTivefunc[:STATe]?
Example:	DISP:ACT OFF
Dependencies:	Grayed out and forced to OFF when **System Display Settings**, **Annotation** is set to Off.
Preset:	On This should remain Off through a Preset when **System Display Settings**, **Annotation** is set to Off
State Saved:	Saved in instrument state.
Key Path:	**View/Display, Display, Annotation**
Initial S/W Revision:	Prior to A.02.00

Title

Displays menu keys that enable you to change or clear a title on your display.

Key Path	**View/Display, Display**
Initial S/W Revision	Prior to A.02.00

Change Title

Writes a title into the "measurement name" field in the banner, for example, "Swept SA".

Press Change Title to enter a new title through the alpha editor. Press Enter or Return to complete the entry. Press ESC to cancel the entry and preserve your existing title.

The display title will replace the measurement name. It remains for this measurement until you press **Change Title** again, or you recall a state, or a Preset is performed. A title can also be cleared by pressing **Title**, **Clear Title**.

NOTE Notice the inclusion of the `<measurement>` parameter in the command below. Because each measurement remembers the Display Title, the command must be qualified with the measurement name. For the Swept SA measurement this is not the case; for backwards compatibility, no <measurement> parameter is used when changing the Display Title for the Swept SA measurement.

Remote Command	`:DISPlay:<measurement>:ANNotation:TITLe:DATA <string>` `:DISPlay:<measurement>:ANNotation:TITLe:DATA?`
Example	DISP:ANN:TITL:DATA "This Is My Title" This example is for the Swept SA measurement in the Spectrum Analyzer mode. The SANalyzer <measurement> name is not used. DISP:ACP:ANN:TITL:DATA "This Is My Title" This example is for Measurements other than Swept SA. Both set the title to: This Is My Title
Initial S/W Revision	Prior to A.02.00
Key Path	**View/Display, Display, Title**
Mode	All
Notes	Pressing this key cancels any active function. When a title is edited the previous title remains intact (it is not cleared) and the cursor goes at the end so that characters can be added or BKSP can be used to go back over previous characters.
Preset	No title (measurement name instead)
State Saved	Saved in instrument state.

Clear Title

Clears a title from the front-panel display. Once cleared, the title cannot be retrieved. After the title is cleared, the current Measurement Name replaces it in the title bar.

Example:	DISP:ANN:TITL:DATA "" clears any existing title characters.
Notes:	Use the :DISPlay:ANNotation:TITLe:DATA <string> command with an empty string.

Preset:	Performed on Preset.
Key Path:	**View/Display, Display, Title**
Initial S/W Revision:	Prior to A.02.00

Graticule

Pressing Graticule turns the display graticule On or Off. It also turns the graticule y-axis annotation on and off.

Remote Command:	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF|ON|0|1` `:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
Example:	DISP:WIND:TRAC:GRAT:GRID OFF
Notes:	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the x-axis and y-axis.
Preset:	On
State Saved:	Saved in instrument state
Key Path:	**View/Display, Display**
Initial S/W Revision:	Prior to A.02.00

Display Line

Activates an adjustable horizontal line that is used as a visual reference line. The line’s vertical position corresponds to its amplitude value. The value of the display line (for example, "–20.3 dBm") appears above the line itself on the right side of the display in the appropriate font.

The display line can be adjusted using the step keys, knob, or numeric keypad. The unit of the Display Line is determined by the **Y axis unit** setting under **Amplitude**. If more than one window has a display line, the display line of the selected window is controlled.

If the display line is off the screen, it shows as a line at the top/bottom of the screen with an arrow pointing up or down. As with all such lines (Pk Thresh, Trigger Level, etc.) it is drawn on top of all traces.

The display line is unaffected by Auto Couple.

Remote Command:	`:DISPlay:WINDow[1]:TRACe:Y:DLINe <ampl>`
	`:DISPlay:WINDow[1]:TRACe:Y:DLINe?`
	`:DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe OFF|ON|0|1`
	`:DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe?`

Example:	DISP:WIND:TRAC:Y:DLIN:STAT ON DISP:WIND:TRAC:Y:DLIN:STAT –32 dBm

Preset:	Set the Display Line to Off and –25 dBm on Preset. When the Display Line goes from Off to On, if it is off screen, set it to either the top or bottom of screen, depending on which direction off screen it was. The Display Line's value does not change when it is turned off.
State Saved:	Saved in instrument state.
Min:	–∞ (minus infinity) in current units
Max:	+∞ (plus infinity) in current units
Key Path:	**View/Display, Display**
Default Unit:	Depends on the current selected Y axis unit
Initial S/W Revision:	Prior to A.02.00

System Display Settings

These settings are "Mode Global" – they affect all modes and measurements and are reset only by **Restore Misc Defaults** or **Restore System Defaults** under System.

Key Path	**View/Display, Display**
Initial S/W Revision	Prior to A.02.00

Annotation Local Settings

This is a Mode Global override of the meas local annotation settings. When it is **All Off**, it forces **Screen Annotation, Meas Bar, Trace, and Active Function Values** settings to be **OFF** for all measurements in all modes. This provides the security based "annotation off" function of previous analyzers; hence it uses the legacy SCPI command.

When it is **All Off,** the **Screen, Meas Bar, Trace,** and **Active Function Values** keys under the **Display, Annotation** menu are grayed out and forced to **Off**. When **Local Settings** is selected, you are able to set the local annotation settings on a measurement by measurement basis.

Remote Command:	`:DISPlay:WINDow[1]:ANNotation[:ALL] OFF|ON|0|1` `:DISPlay:WINDow[1]:ANNotation[:ALL]?`
Example:	:DISP:WIND:ANN OFF
Preset:	On (Set by Restore Misc Defaults)
State Saved:	Not saved in instrument state.
Key Path:	**View/Display, Display, System Display Settings**
Initial S/W Revision:	Prior to A.02.00

Theme

This key allows you to change the Display theme. This is similar to the Themes selection under Page Setup and

Save Screen Image. The four themes are detailed below.

Remote Command:	`:DISPlay:THEMe TDColor|TDMonochrome|FCOLor|FMONochrome` `:DISPlay:THEMe?`
Preset:	TDColor (Set by Restore Misc Defaults)
State Saved:	Not saved in instrument state.
Key Path:	**View/Display, Display, System Display Settings**
Notes:	TDColor – 3D is the standard color theme with filling and shading TDMonochrome – is similar to 3D color, but only black is used FCOLor – flat color is intended for inkjet printers to conserve ink. It uses a white background instead of black. FMONochrome – is like flat color, but only black is used
Example:	DISP:THEM TDM sets the display theme to 3D Monochrome.
Initial S/W Revision:	Prior to A.02.00

Backlight

Accesses the display backlight on/off keys. This setting may interact with settings under the Windows "Power" menu.

When the backlight is off, pressing ESC, TAB, SPACE, ENTER, UP, DOWN, LEFT, RIGHT, DEL, BKSP, CTRL, or ALT turns the backlight on without affecting the application. Pressing any other key will turn backlight on and could potentially perform the action as well.

Remote Command:	`:DISPlay:BACKlight ON|OFF` `:DISPlay:BACKlight?`
Preset:	ON (Set by Restore Misc Defaults)
Key Path:	**View/Display, Display, System Display Settings**
Initial S/W Revision:	Prior to A.02.00

On

Turns the display backlight on.

Example:	DISP:BACK ON
Key Path:	**View/Display, Display, System Display Settings, Backlight**
Readback:	On
Initial S/W Revision:	Prior to A.02.00

Off

Turns the display backlight off.

Example:	DISP:BACK OFF
Key Path:	**View/Display, Display, System Display Settings, Backlight**
Readback:	Off
Initial S/W Revision:	Prior to A.02.00

Backlight Intensity

An active function used to set the backlight intensity. It goes from 0 to 100 where 100 is full on and 0 is off. This value is independent of the values set under the Backlight on/off key.

Remote Command:	`:DISPlay:BACKlight:INTensity <integer>` `:DISPlay:BACKlight:INTensity?`
Example:	DISP:BACK:INT 50
Preset:	100 (Set by Restore Misc Defaults)
Min:	0
Max:	100
Key Path:	**View/Display, Display, System Display Settings**
Initial S/W Revision:	Prior to A.02.00

Full Screen

When **Full Screen** is pressed the measurement window expands horizontally over the entire instrument display. The screen graticule area expands to fill the available display area.

It turns off the display of the softkey labels, however the menus and active functions still work. (Though it would obviously be very hard to navigate without the key labels displayed.) Pressing **Full Screen** again while Full Screen is in effect cancels Full Screen.

Note that the banner and status lines are unaffected. You can get even more screen area for your data display by turning off the Meas Bar (in the Display menu) which also turns off the settings panel.

Full Screen is a Meas Global function. Therefore it is cancelled by the **Preset** key.

Remote Command:	`:DISPlay:FSCReen[:STATe] OFF|ON|0|1` `:DISPlay:FSCReen[:STATe]?`
Preset:	Off
State Saved:	Not saved in instrument state.
Key Path:	**Display**

Backwards Compatibility SCPI:	:DISPlay:MENU[:STATe] OFF|ON|0|1
Backwards Compatibility SCPI:	DISPlay:MENU[:STATe] emulates ESA full screen functionality, which is the same as the FSCReen command in PSA except that the sense of on/off is reversed (that is, OFF means the menus are OFF) and the default is ON.
Initial S/W Revision:	Prior to A.02.00

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit so you can tell that the instrument is on. The display enable setting is mode global. The reasons for turning the display off are three:

- To increase speed as much as possible by freeing the instrument from having to update the display
- To reduce emissions from the display, drive circuitry
- For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending the SYSTem:DEFaults MISC command or the DISPlay:ENABle ON (neither *RST nor SYSTem:PRESet enable the display.)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys or by sending the SYSTem:DEFaults MISC command or the DISPlay:ENABle ON (neither *RST nor SYSTem:PRESet enable the display.)

and you are using either the SYSTem:KLOCk command or GPIB local lockout, then no front-panel key press will turn the display back on. You must turn it back on remotely.

Remote Command:	`:DISPlay:ENABle OFF|ON|0|1` `:DISPlay:ENABle?`
Example:	DISP:ENAB OFF
Couplings:	DISP:ENAB OFF turns Backlight OFF and DISP:ENAB ON turns Backlight ON. However, settings of Backlight do not change the state of DISP:ENAB
Preset:	On Set by SYST:DEF MISC, but Not affected by *RST or SYSTem:PRESet.
State Saved:	Not saved in instrument state.
Initial S/W Revision:	Prior to A.02.00

Common Measurement Functions 2

The key and command descriptions in this section describe functions that operate identically in multiple measurements and/or modes. This section is a library of functions that is referenced by many measurements and modes

To find the exact description and parameters for functions in a specific measurement, always look in the measurement section of this documentation. Pressing the front-panel key or softkey and then pressing the green Help key also provides the correct information.

NOTE If you want to print the documentation, be sure to select this section and the measurement of interest to ensure having all the information you need. See “Printing Acrobat Files” on page 81 for further instructions about printing.

AMPTD Y Scale (Amplitude)

This menu has controls for the input signal conditioning as well as the Y-scaling of trace data. Input signal conditioning actually affect the input signal and the associated measurement quality, whereas Y-scaling is non-destructive of data. Even if the data is scaled so as to be clipped or completely off the display, the marker readouts are still correct and accurate data may still be retrieved via SCPI.

Key Path	**Front Panel**
Initial S/W Revision	Prior to A.02.00

Range

The Range setting represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-rms ratios, the range may need to exceed the rms signal power by a fair amount to avoid clipping.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	POW:RANG 25 POW:RANG?
Notes	The parameter is interpreted as dBm
Preset	20
State Saved	Saved in instrument state.
Min	depends on model and preamp options

Max	depends on model and preamp options
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Y Axis Scaling

Y axis scaling allows you to view the entire range of the data or zoom in on a range of interest. Scaling does not affect measurement setup, and rescaling can be done at any time on paused or complete measurements and the results of the rescaling are immediately visible. Y scaling can be made to track range setting for convenience in setting up measurements.

Key Path	**AMPTD Y-Scale**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Select Trace

This function is a duplicate of the same function found on the Trace/Detector menu. The Select Trace key is also located here to allow you to conveniently choose which trace the Y scaling applies.

See “Select Trace” on page 428 for details.

Key Path	**AMPTD Y-Scale, Y Axis Scaling**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Y Auto Scale

This immediate action key causes the Y reference value and Scale per Division to change so as to display the full trace without clipping.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:AUTO:ONCE`
Example	:DISP:VECT:TRAC1:Y:AUTO:ONCE
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Y Reference Value

This function controls the Y value of the selected trace at the Reference Position. It has no effect on hardware input settings.

See "Y Reference: Position" on page 364 for more details.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:RLEVel <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:RLEVel?`
Example	DISP:VECT:TRAC:Y:RLEV 20 DISP:VECT:TRAC:Y:RLEV?
Couplings	None. This does not affect any hardware input settings.
Preset	Depends on trace
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Y Scale Per Division

This controls the Y scale per division of the selected trace.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:PDIVision <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:PDIVision?`
Example	DISP:VECT:TRAC:Y:PDIV 10 DISP:VECT:TRAC:Y:PDIV?
Couplings	None.
Preset	Depends on trace
State Saved	Saved in instrument state.

Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Couple Ref to Range

When Couple Ref to Range is on, a Y scaling is adjusted when the Range changes. For example, on traces with Y units of dBm, the reference value changes by the same amount in dB as the Range does. On a trace with Y units of Volts, the Per Division setting changes by a factor of approx. 1.25 when the Range changes by 2 dB. This function may be turned on or off on for each individual trace.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	:DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:RLEVel:AUTO OFF|ON|0|1 :DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:RLEVel:AUTO?
Example	DISP:VECT:TRAC1:Y:RLEV:AUTO ON DISP:VECT:TRAC1:Y:RLEV:AUTO?
Notes	Range coupling is not available for Phase and Group delay traces.
Preset	1
State Saved	Saved in instrument state.
Range	On | Off
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Y Reference: Position

This determines the position of the reference line for Y scaling for the selected trace. It may be set to the top, bottom, or center of the grid.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	:DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:RPOSition TOP|CENTer|BOTTom :DISPlay:<meas>:TRACe[1]|2|3|4:Y[:SCALe]:RPOSition?
Example	DISP:VECT:TRAC1:Y:RPOS TOP DISP:VECT:TRAC1:Y:RPOS?
Couplings	Changing trace format or data can affect this. Each format "remembers" its reference position.
Preset	Depends on trace format and trace data. Top for LogMag or most LinearMag traces, middle for Real, Imaginary, Vector displays, Eye diagrams, Phase, Delay, Bottom for Linear Mag EVM
State Saved	Saved in instrument state.
Range	Top|Ctr|Bottom
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Y Unit Preference

This determines the preferred Y unit for the selected trace. You can select Peak, RMS, Power units, or an automatic selection. The automatic selection is to show Power units for frequency domain data and Peak units for time domain data.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	:DISPlay:<meas>:TRACe[1]|2|3|4:Y:UNIT:PREFerence AUTO|PEAK|RMS|POWer|MRMS :DISPlay:<meas>:TRACe[1]|2|3|4:Y:UNIT:PREFerence?
Example	DISP:VECT:TRAC1:Y:UNIT:PREF PEAK DISP:VECT:TRAC1:Y:UNIT:PREF?
Preset	AUTO
State Saved	Saved in instrument state.
Range	AUTO|PEAK|RMS|POW|MRMS
Readback Text	Auto|Peak|RMS|Power|mRMS
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

The following SCPI only command can be used to determine exactly which Y unit was chosen based on the setting of the above:

<table>
<tr><td>Key Path</td><td>AMPTD/YScale</td></tr>
<tr><td>Mode</td><td>VSA, LTE, LTETDD, IDEN</td></tr>
<tr><td>Measurement</td><td><meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk</td></tr>
<tr><td>Remote Command</td><td>:DISPlay:<meas>:TRACe[1]|2|3|4:Y:UNIT?</td></tr>
<tr><td>Example</td><td>DISP:VECT:TRAC1:Y:UNIT?</td></tr>
<tr><td>Initial S/W Revision</td><td>Prior to A.02.00</td></tr>
<tr><td>Modified at S/W Revision</td><td>A.02.00</td></tr>
</table>

Y Log Ratio

This property is only used if the Trace Format is set to LogMag (Linear Unit). In this format type, you set the Y Log Ratio instead of Y Scale Per Division to determine Y scaling. It sets the ratio of the top of the Y axis to the bottom.

<table>
<tr><td>Key Path</td><td>AMPTD/YScale</td></tr>
<tr><td>Mode</td><td>VSA, LTE, LTETDD, IDEN</td></tr>
<tr><td>Measurement</td><td><meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk</td></tr>
<tr><td>Remote Command</td><td>:DISPlay:<meas>:TRACe[1]|2|3|4:Y:LRATio <real>
:DISPlay:<meas>:TRACe[1]|2|3|4:Y:LRATio?</td></tr>
<tr><td>Example</td><td>DISP:VECT:TRAC1:Y:LRAT 10000
DISP:VECT:TRAC1:Y:LRAT?</td></tr>
<tr><td>Notes</td><td>This is grayed out if the trace format is not Log Mag (linear unit).</td></tr>
<tr><td>Preset</td><td>100000</td></tr>
<tr><td>State Saved</td><td>Saved in instrument state.</td></tr>
<tr><td>Min</td><td>1.001</td></tr>
<tr><td>Max</td><td>100e6</td></tr>
<tr><td>Initial S/W Revision</td><td>Prior to A.02.00</td></tr>
<tr><td>Modified at S/W Revision</td><td>A.02.00</td></tr>
</table>

Vector Horiz Center

The Vector trace formats are I-Q and Constellation. When you are in one of these formats you set the vertical (imaginary) axis scaling with the Y Reference Value, Y Reference Position, and Y Scale Per Division properties. The scaling of the horizontal axis is set so as to maintain an aspect ratio of 1:1. The

Vector Horiz Center property is used to set the position of the origin.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:VHCenter <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:VHCenter?`
Example	DISP:DDEM:TRAC1:VHC 0.2 DISP:DDEM:TRAC1:VHC?
Preset	0
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Copy Y Scale

This front-panel only function copies the following Y scaling information from the selected trace to another:

- Y reference Position
- Y Reference Value
- Y Unit Preference
- Vector Horiz Center
- Couple Ref to Range
- Y Log Ratio
- Y Reference Line

Key Path	**AMPTD Y-Scale, Y Axis Scaling**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Reference Line

This controls whether the Y reference line is visible or not.

Key Path	**AMPTD/YScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:RLINe OFF|ON|0|1` `:DISPlay:<meas>:TRACe[1]|2|3|4:RLINe?`
Example	DISP:VECT:TRAC1:RLIN ON DISP:VECT:TRAC1:RLIN?
Preset	OFF
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

BW (Bandwidth)

The BW key allows you to control the resolution bandwidth of the spectrum measurement result, as well as the shape of the resolution bandwidth filter (controlled by the FFT windowing function).

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Res BW

This key allows you to select the resolution bandwidth of the measurement. Res BW is mathematically related to Time length and Window type, so changing one of these, directly or indirectly, must change at least one other.

Res BW and Time length are related by the following equation:

Res BW = ENBW / T

where:

ENBW is the normalized effective noise bandwidth of the Window. See "FFT Window" on page 371 for more details).

T is the time record length.

Therefore, **if you change Res BW, Main Time must also change**, and vice versa. (If the Gate function is on, then it is Gate Length, not Main Time, that is related to Res BW by the above equation.)

For convenience, Res BW is by default also coupled to Span (but not vice versa). This coupling may be turned off. See "Res BW Coupling" on page 369 for more details.

Limits:

The minimum Res Bw to Span ratio is related to the maximum Main Time length, and is given by:

ENBW / 409600 if Freq points state parameter is set to Auto

ENBW / (Freq Points – 1)if Freq points parameter is manually set

The maximum Res BW to Span ratio is related to the minimum time record size (16 points for most windows, 17 points for Flat Top), and is given by:

ENBW / 12.5

(ENBW / 13.28125 for Flat Top window)

See the "Main Time" on page 434 topic for more on relationships between Res BW and time.

Key Path	**BW**
Mode	VSA
Measurement	<meas>:=VECTor|ADEMod|IPOWer|IDEMod|MOTotalk
Remote Command	`[:SENSe]:<meas>:BANDwidth|BWIDth[:RESolution] <bandwidth>` `[:SENSe]:<meas>:BANDwidth|BWIDth[:RESolution]?`
Example	VECT:BWID 200 KHZ VECT:BWID?
Notes	Key blanked in any other measurement than Vector or Analog Demod
Couplings	Changing Main Time or Gate Length changes Res BW. See Res BW Coupling for other changes that can affect (or be affected by) Res BW
Preset	300 kHz
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Res BW Coupling

This property controls how Res BW is affected by other parameters. The three possible settings are:

Span: (default) This setting keeps the ratio of Res BW:Span constant whenever the Span is changed. However, you can change the Res BW at will, and doing so establishes a new Res BW:Span ratio.

Min: This setting is only available when the Freq Points property is manually set, and is disabled (forceful grey out) when Freq Points is Auto. It maintains the RBW at the minimum possible value given the settings for Freq Points, Span, and Window. Res BW coupling is changed from Min to Span if you manually set Res BW.

Fixed: This setting attempts to keep the Res BW setting fixed as Span, Freq Points, or FFT Window type change. Changing FFT Window will cause Main Time (or Gate) length to change in order to keep the Res BW Fixed. Res BW coupling is forced to Fixed mode any time you turn time the Gate function on or manually set Main Time length. See "Main Time" on page 434 for details.

If a requested change to Res BW or Time Length (Main or Gate) would cause the Res BW to go outside the minimum or maximum Res BW: Span limits (see the main Res BW section for specifics), the Res BW is clipped at the appropriate limit. The Time length is then set to according to the limited Res BW.

In Fixed coupling mode, if increasing the Span would cause the new Res BW:Span to drop below the minimum, or if decreasing Span would cause the new Res BW: span to exceed the maximum, the requested Span is accepted and then the Res BW is changed to the limiting value. The associated Time length is updated.

In Fixed or Span coupling, increasing Freq Points does not cause the Main (or Gate) Time Length to increase. It only adds zero padding to the array that is used in the FFT to calculate the Spectrum. Therefore, it will not affect Res BW. If decreasing Freq Points decreases the maximum time length below the current Main Time, then the Main Time length is clipped to the new limits. If Gating is on, the Gate Delay is first limited, then the Gate Length. The Res BW is then updated as a result of the Time changes.

In Fixed or Span coupling, changing the Window Type will not affect RBW unless it falls outside the limits calculated using the new window. Then the Res BW is clipped at the appropriate limit. The associated Time length is also updated.

Key Path	**BW**
Mode	VSA
Measurement	<meas>:=VECTor|ADEMod|IPOWer|IDEMod|MOTotalk
Remote Command	`[:SENSe]:<meas>:BANDwidth|BWIDth[:RESolution]:COUPle SPAN|MIN|FIXed` `[:SENSe]:<meas>:BANDwidth|BWIDth[:RESolution]:COUPle?`
Example	VECT:BWID:COUP FIX VECT:BWID:COUP?
Notes	Blanked when in any other measurement than Vector or Analog Demod MIN is not available if Freq Points is set to Auto and trying to set it generates error –221 Settings conflict
Couplings	See narrative above table and also Res BW section
Preset	SPAN
State Saved	Saved in instrument state.
Range	Span | Min | Fixed

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

FFT Window

This key allows you to choose the Window function that is applied to the time data prior to the FFT calculation used for Spectrum and PSD displays. Four windows are available.

Window name	Common usage	Normalized ENBW (Hz-s)
Uniform	Transient or self-windowing signals, signals that are periodic within a time record length.	1.0
Hanning	Frequency resolution	1.5
Gaussian	High dynamic range	2.21536
Flat Top	High amplitude accuracy	3.8194

The normalized ENBW is the equivalent noise bandwidth, that is, the width of a rectangular filter that passes the same amount of white noise as the window. It is used to define the resolution bandwidth.

Key Path	**BW**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`[:SENSe]:<meas>:FFT:WINDow[:TYPE] UNIForm|HANNing|GAUSsian|FLATtop` `[:SENSe]:<meas>:FFT:WINDow[:TYPE]?`
Example	VECT:FFT:WIND GAUS VECT:FFT:WIND?
Couplings	See Res BW and Res BW Coupling sections
Preset	FLAT
State Saved	Saved in instrument state.
Range	Uniform | Hanning | Gaussian (High Dyn Rng) | Flat Top (High Amptd Accy)
Readback Text	Uniform | Hanning | Gaussian | Flat Top
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

FREQ Channel

Frequency parameters for any vector measurement consist of 2 pairs of properties: Center Frequency and

Span or Start Frequency and Stop Frequency. These behave much as they do in any other application, but there is the additional constraint that the span is limited to much less than the center frequency range.

If you change center frequency the start and stop frequencies change by the same amount.

If you change span, start frequency and stop frequency are changed by 1/2 the span change.

If you change start frequency, stop frequency remains fixed and span and center frequency are refigured accordingly. Changing stop frequency has similar behavior.

Limits:

If you change the start frequency such that it will equal or exceed the stop frequency, the new start frequency will be accepted if possible and the stop frequency will be set to min span above the start. Similarly if you attempt to set the stop below the start, the start frequency will move to a min span below the new stop frequency.

If you reduce the start frequency beyond a max span below the stop, the stop frequency will be "dragged along" such that it will be a max span above the new start frequency, and similarly increasing the stop frequency will drag the start frequency along if you attempt to increase the span beyond the maximum.

Stop frequency may be 1/2 span above the maximum center frequency, but frequency-domain traces are blanked above the maximum center frequency.

Start frequency may be 1/2 span below the minimum center frequency, but frequency-domain traces are blanked below the minimum center frequency.

Pressing the Freq hardkey changes the active function to Center Frequency.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Center Freq

Sets the frequency of the display Center.

Key Path	**FREQ Channel**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`
Example	FREQ:CENT 985 MHZ FREQ:CENT?
Couplings	Start Freq, Stop Freq, and Span. See “FREQ Channel” on page 371 for more details.
Preset	1 GHz

State Saved	Saved in instrument state.
Min	0 Hz
Max	Depends on frequency range option.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Start Freq

Sets the frequency of the display Start.

Key Path	**FREQ Channel**
Mode	VSA, IDEN
Remote Command	`[:SENSe]:FREQuency:STARt <freq>` `[:SENSe]:FREQuency:STARt?`
Example	FREQ:STAR 980 MHz FREQ:STAR?
Couplings	Stop Freq, Center Freq, and Span. See “FREQ Channel” on page 371 for more details.
Preset	Depends on span option. It is 1/2 max span below 1 GHz
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Stop Freq

Sets the frequency of the display Stop.

Key Path	**FREQ Channel**
Mode	VSA, IDEN
Remote Command	`[:SENSe]:FREQuency:STOP <freq>` `[:SENSe]:FREQuency:STOP?`
Example	FREQ:STOP 990 MHz FREQ:STOP?
Couplings	Start Freq, Center Freq, and Span. See “FREQ Channel” on page 371 for more details.

Preset	Depends on span option. It is 1/2 max span above 1 GHz
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

CF Step

This key controls the amount the center frequency changes if it is the active function and the user presses the Up or Down arrow key. Note: the start and stop frequency also change by the amount of the CF Step if the Up/Down arrow keys are used to change them; but the key is mainly used is in connection with stepping the center frequency, so the legacy key name has been retained. The step size in Auto mode is 1/10th the span. It can be set to any value in manual mode.

Key Path	**FREQ Channel**
Mode	VSA, LTE, LTETDD, IDEN

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF|ON|0|1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	FREQ:CENT:STEP 1 MHZ FREQ:CENT:STEP? FREQ:CENT:STEP:AUTO ON FREQ:CENT:STEP:AUTO?
Couplings	1/10th Span when auto is turned on
Preset	Depends on span option; 1/10th default span.
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker

The Marker hardkey displays the Marker menu. A marker can be placed on a trace to allow the value of the trace data at the marker position to be determined precisely. Markers can also be used in pairs to read the difference (or delta) between two data points. They can also be used to make power calculations over a band of frequencies or a time interval. See Marker Functions below for more details.

The functions in this menu include a 1-of-N selection of the control mode **Normal, Delta, Fixed,** or **Off** for the selected marker. The control mode is described below.

Pressing **Marker** always makes the selected maker's X position the active function.

If the currently selected marker is **Off**, pressing **Marker** sets it to **Normal** mode and places it at the center of the screen on the currently selected trace.

As a convenience, if there are no markers displayed on the current trace, pressing the marker hardkey (whenever the marker menu is already showing) selects the lowest numbered marker that is currently off and turns it on in normal mode on the selected trace. In other words, pressing the Marker hardkey twice will always turn on a marker on the selected trace if none was turned on before.

For more information see the Analyzer Setup, Marker for a description of this function.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Select Marker

Specifies the selected marker. The selected marker is the one that is affected by the marker position and properties settings, peak search, and other marker functions. Several menus have a Select Marker key for convenience. Marker selection using any one of these is reflected in all others, i.e., there is only one selected marker for the whole measurement. If all markers are off, then marker 1 becomes the selected marker.

As a convenience, if no markers are displayed on the selected trace, selecting a marker that is off automatically turns it on in normal mode on the selected trace.

There is no SCPI function for selecting a marker. Instead, SCPI functions may explicitly include the index of the marker for which they are to apply. (Most SCPI marker functions that affect the state of a marker will also make it the selected marker for front panel commands.)

Key Path	**Marker or Marker> or Marker Function**
Mode	VSA, LTE, LTETDD, IDEN
State Saved	No
Range	1|2|3|4|5|6|7|8|9|10|11|12
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Control Mode

The control mode of the selected marker is selected by pressing **Normal**, **Delta**, **Fixed**, or **Off**. The behavior of a marker under each control mode is described below the table. The current control mode is shown by highlighting the appropriate key.

The SCPI command in the table below selects the marker and sets the marker control mode as described under Normal, Delta, Fixed and Off, below. All interactions and dependencies detailed under the key description are enforced when the remote command is sent.

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MODE POSition|DELTa|FIXed|=OFF` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MODE?`
Example	CALC:VECT:MARK1:MODE POS CALC:VECT:MARK1:MODE?
Couplings	When Delta mode is selected, or when the mode is changed from Delta to Off, the marker relative to the selected marker may be affected, as described in the text descriptions below.
Preset	=OFF
State Saved	Saved in instrument state.
Range	Normal|Delta|Fixed|Off
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Normal (Position)

A marker in normal mode reports the trace data value (Y value) at a particular point on a trace. The marker's absolute X (and Z) position is specified by you in displayed units. The marker symbol appears on the trace at the specified position and tracks the absolute Y value at that position as it changes from scan to scan. The absolute Y value is displayed in the marker readout area. In older instruments this was called Position mode, and the designation may still be used for backward compatibility.

For Control Mode SCPI command information see: “Control Mode” on page 375

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Delta

A marker set to delta mode reports the difference between Y values at two points. A delta marker is relative to an associated reference marker on the same trace. (The reference marker may be set on the Marker, Properties, Relative To menu). The reference marker is usually fixed, but may also be normal or delta. The X (and Z) position of a delta marker is specified as an offset from the reference marker position. The delta marker symbol tracks the absolute Y value just like a normal marker, but the marker readout displays the difference between the absolute Y values of the delta marker and its reference marker (absolute units are used even if the reference is itself a delta marker). Usually this is a straight difference in the current displayed units. For example, if the trace format is LogMag (dBm), the delta marker displays the difference in dB, thus showing a power ratio. But if the trace format is Real, then the delta marker shows a voltage difference, not a ratio. Exceptions for this are:

- When the trace format is Linear Mag or Log Mag (linear unit) the delta marker displays a voltage ratio, or (if the Y Axis unit is Power) a power ratio, rather than a difference.
- When either the marker or its reference has a marker function turned on, the delta marker always displays a ratio or its decibel equivalent. See Marker Function for more details on how delta markers work with marker functions. The type of ratio calculated (power or voltage) depends on the delta marker units; the reference marker value is converted as needed so it has compatible units.
- When the trace format is Wrap Phase, the delta marker readout is constrained to the wrapped phase display range, which is usually (–180, +180] degrees. For example, if the absolute phase at marker 1 is 170 deg and its reference has phase of –170 deg, the delta will not show 340 deg, but –20 deg. Note that the Wrap Phase display range can be changed (see Trace/Detector, Phase/Delay Properties, Phase/Trellis Offset).

There is no current support for calculating deltas across traces (and this cannot be done at all unless the traces have the same domain and ranges).

By default, the reference marker for marker 1 is marker 2; for marker 2 is 3 and so on, but the reference marker may be changed. See the section on the "Relative To" softkey below.

The following coupling rules apply from the front panel, and also if the equivalent SCPI commands are sent.

Pressing the Delta key causes the selected marker becomes a delta marker if it is not already. Also, the selected marker's reference is affected as follows:

- If the reference marker was off, it is turned on as a fixed marker.
- The reference marker is moved to the trace of the selected marker and set to the same position as the selected marker.
- If the delta marker has a marker function turned on, the reference marker takes on the same function (with the same band limits).

Exception: Pressing Delta when the selected marker's mode is not yet Delta does not move or change a reference marker that is already turned on (Normal, Delta, or Fixed) and on the same trace as the selected marker. It merely changes the selected marker's mode to Delta and shows the current offset between it and the reference. If you press Delta again (when the selected marker is already in Delta mode) then the reference is moved and modified as described above.

When a delta marker is changed to any other control mode, if its reference marker is fixed then the reference marker is also turned off.

If you move a delta marker to a different trace, it is forced to Normal mode, and if its reference is fixed, the reference is turned off.

A delta marker is forced to Normal mode if you turn its reference off, or if you move its reference to another trace. (In the latter case the reference is not turned off even if it is fixed.)

If you change the selected marker's reference (using the Marker, Properties, Relative To) the selected marker is forced to Delta mode. This change of the selected marker to Delta mode causes its new reference's control mode and position to change as described above.

For Control Mode SCPI command information see: “Control Mode” on page 375

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Fixed

Fixed markers are mainly used as reference markers for Delta markers. A fixed marker's X and Y Axis values may be directly or indirectly specified by you, and they remain fixed once specified, i.e. they do not follow the trace data value. These markers are represented on the display by an “X” rather then a diamond. If a marker is changed from off to fixed, the X and Y (and Z) values are chosen to put it in the center of the display. If the marker is changed from some other type to fixed, the current X and Z values of the marker remain unchanged. The Y value is taken from the current trace data value and must be changed manually thereafter.

For Control Mode SCPI command information see: “Control Mode” on page 375

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Off

Turning a marker off makes it invisible, and also its annotation.

Turning a marker on (i.e. changing its control mode from Off to any other control mode) assigns the marker to the currently selected trace.

For Control Mode SCPI command information see: “Control Mode” on page 375

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Position

Marker position is used to select which data point in a trace we want to read out with the marker (or where to locate a fixed marker). The marker position is primarily set in terms of the domain units, not trace points (although it can be set in terms of points via SCPI). The default active function when you press a marker hard key is the X position for the currently selected marker. The exception to this is when the selected marker is fixed. In that case there is no default active function (to prevent inadvertently changing a fixed marker's location).

Marker position is not defined when a marker's control mode is Off. When a marker is turned on in Normal or Delta mode, its X (and Z) values are set to the center of the trace data. If a marker is turned on in Fixed mode, its position is set so that it appears in the middle of the trace grid.

The Marker Position key branches to the Marker Position menu, which allows you to set any position variable relevant to the selected marker's control mode and trace format.

For Normal and Delta markers, usually only Marker X is available. Marker Z is available for trace data with 2-dimensional domain. For Fixed markers, Y may also be set. If the trace format is Vector or Constellation, Marker Y controls the real (horizontal axis) value and Marker Y Imag controls the imaginary (vertical axis) value. The key (or the keys below it) is grayed out if the selected marker is off.

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker X

This sets the selected marker's X Axis value position in the current X Axis Scale unit. If the control mode is Off, the SCPI command has no effect other than to cause the marker to become selected. Note that the X value may change if the marker is moved to a trace with a different domain.

The Marker X position is absolute if the marker control mode is Normal or Fixed. If the control mode is Delta, then the X position is relative to the reference marker. The valid X positions are the actual data points in the trace; the marker cannot be located between points. If a SCPI command attempts to place the marker between two points, the X value snaps to the closest point.

Note that for Vector or Constellation format, the X axis is perpendicular to the screen (because the screen axes are used to show the real and imaginary parts of the Y value), so adjusting the X value in this case will only cause the marker to move horizontally if the real Y value changes. For Fixed markers on a trace with one of these formats, adjusting the X value will not cause horizontal motion of the marker at all. Instead, you use the Marker Y and Marker Y (imag) controls to move the marker horizontally and vertically.

Key Path	**Marker, Marker Position**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X <real> :CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X?
Example	CALC:VECT:MARK:X 0.325 CALC:VECT:MARK:X?
Notes	Marker X will not go outside the bounds of the data unless it is Fixed. If you attempt to set it to a value outside the bounds it will be clipped at the closest limit, and error –222 Data Out of Range is generated. If suffix is sent, it must match the X units for the trace the marker is on. Otherwise, error –138, "Suffix not allowed" is generated. If you try to read or set the position of a Delta marker, remember that the position is in relative units.
Couplings	See Coupling at the end of the Control Mode section. See also Couple Markers section.
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace data
Max	Depends on trace data
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

SCPI only X position commands

Via SCPI , the marker position may also be set or queried in trace points. In this case, the position setting or reading is absolute regardless of control mode.

NOTE The entered value in Trace Points is immediately translated into the current domain units for setting the value of the marker. The marker's value in domain units, NOT trace points, will be preserved if a change is made to the X Axis scale settings. Thus, if you use this command to place a marker on point 500, which happens at that time to correspond to 13 GHz, and then you change the Start Frequency so that point 500 is no longer 13 GHz, the marker will stay at 13 GHz, NOT at point 500.

If the trace the marker is on has a 2-dimensional domain, then the points are numbered in the following way:

Starting at the minimum X and Z position, this point is numbered 0. Each time you increment the point number, increment the X value to the next available value. When X reaches the maximum X position, then reset X to the minimum and increment the Z value. Then continue incrementing the X position in the same manner as before.

Note that for symbol tables, which have no axes, incrementing the X position in points moves the marker consecutively through all table entries.

Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:X]:POSition <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12[:X]:POSition?`
Example	CALC:VECT:MARK:POS 25 CALC:VECT:MARK:POS?
Notes	When a marker control mode is changed from off to any other mode, the X position is set to mid-screen.
Couplings	Same couplings as for Marker X value
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace data
Max	Depends on trace data
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker X Unit may be queried via SCPI.

Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:X:UNIT?`
Example	CALC:VECT:MARK:X:UNIT?
Notes	Query Only
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Y

This function only affects fixed markers. It allows you to set or read back the selected marker's Y Axis value in the current Y Axis Scale unit. Setting the Y value has no effect (other than to cause the marker to become selected) if the control mode is other than fixed. The query form generates an error if the control mode is Off. Note that the Y value may change if the Y-axis units change, either from a change in format of the trace the marker is on, or if the marker is moved to a different trace.

If the selected marker is on a trace that is displayed with Vector or Constellation format, this function controls only the real part of the Y value (i.e., the horizontal axis value). Use the Marker Y (imag) control to change the imaginary (vertical) value. Marker Y and Marker Y Imag always set or get the rectangular form of Y, regardless of whether the marker readout is polar or rectangular.

Key Path	**Marker, Marker Position**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Y[:REAL] <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Y[:REAL]?`
Example	CALC:VECT:MARK2:Y 0.325 CALC:VECT:MARK2:Y?
Notes	You cannot set Y unless the marker type is fixed. If the marker becomes fixed after a marker function is turned on, it is set to whatever the Y value was when the marker became fixed. If suffix is sent, it must match the Y units for the trace the marker is on. Otherwise, error –138, "Suffix not allowed" is generated.
Couplings	Changes if marker is relative to a Delta marker that is turned on or re-zeroed (see Coupling of Delta and Reference Markers).
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Y Unit may be queried via SCPI.

Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Y:UNIT?`
Example	CALC:VECT:MARK:Y:UNIT?

Notes	Query Only
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Y Imag (Imaginary)

This only affects fixed markers and is only available when the trace format is Vector or Constellation. It allows you to set or read back the selected marker's quadrature (imaginary) Y value in the current Y Axis Scale unit. It has no effect (other than to cause the marker to become selected) if the control mode is other than fixed, or if the current trace format is not complex. The query form generates an error if it is used for a marker that is not on a complex trace. Marker Y Imag is not affected by whether the marker readout is polar or rectangular.

Key Path	**Marker, Marker Position**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Y:IMAGinary <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Y:IMAGinary?`
Example	CALC:DDEM:MARK1:Y:IMAG 0.435 CALC:DDEM:MARK1:Y:IMAG?
Notes	Grayed out unless the marker is fixed and on a vector display. If suffix is sent, it must match the Y units for the trace the marker is on. Otherwise, an Invalid Suffix error is generated. Otherwise, error –138, "Suffix not allowed" is generated. If query is sent while the marker is on a trace whose format is not vector or constellation, NaN (9.91E+37) is returned.
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace format
Max	Depends on trace format
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Z

For markers on traces with a 2-dimensional domain, this sets the selected markers Z Axis value in the current Z Axis Scale unit. In each case the marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is **Off**, or if the trace has no Z domain. Note that the Z value may change or become irrelevant if the marker is moved to a trace with a different Z domain, or no Z domain.

Note that this Z value is affected if the SCPI command to set marker point position is used.

Key Path	**Marker, Marker Position**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Z <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Z?`
Example	CALC:OFDM:MARK:Z 12 CALC:OFDM:MARK:Z?
Notes	Marker Z will not go outside the bounds of the data unless it is Fixed. If you attempt to set it to a value outside the bounds it will be clipped at the closest limit, and error –222 Data Out of Range is generated. If suffix is sent, it must match the Z units for the trace the marker is on. Otherwise, error –138, "Suffix not allowed" is generated.
Couplings	See Coupling at the end of the Control Mode section. See also Couple Markers section.
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace data
Max	Depends on trace data
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Z Unit may be queried via SCPI.

Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:Z:UNIT?`
Example	CALC:OFDM:MARK:Z:UNIT?
Notes	Query Only
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Properties

The Marker Properties key accesses a menu of common marker properties.

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00

Relative To

This key allows you to specify which marker is used as a reference for the selected marker when the selected marker's control mode is set to Delta. By default, the reference marker is numerically one higher than the selected marker, that is, marker 1 is relative to marker 2, marker 2 to marker 3, and so on. Marker 12 by default is relative to marker 1. This key allows you to change the reference marker from the default. Note that a marker cannot be made relative to itself.

Key Path	**Marker, Properties**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:REFerence <integer>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:REFerence?`
Example	CALC:VECT:MARK2:REF 4 CALC:VECT:MARK2:REF?
Notes	The reference marker cannot be the same value as the selected marker, i.e.,. a marker cannot be relative to itself. The currently selected marker will not be an available choice in the relative to selection (i.e. the selected marker will appear grayed out). When queried a single value will be returned (the specified marker numbers relative marker).
Couplings	See Coupling of Delta and Reference Markers above. The old reference remains as it was.
Preset	2|3|4|5|6|7|8|9|10|11|12|1
State Saved	Saved in instrument state.
Range	1|2|3|4|5|6|7|8|9|10|11|12
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Complex Format

This determines the format for the readout when a marker is placed on a complex display (vector or constellation). The choices are to read out in rectangular or polar coordinates. The readout format applies to the marker display and marker table only; there is no SCPI for reading out the marker value in polar form.

Key Path	**Marker, Properties**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:CFORmat RECTangular|POLar` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:CFORmat?`
Example	CALC:VECT:MARK1:CFOR RECT CALC:VECT:MARK1:CFOR?
Preset	RECT
State Saved	Saved in instrument state.
Range	Rect|Polar
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Trace

This key allows you to determine the trace to which a marker is assigned. By default, when a marker is turned on it is assigned to the currently selected trace. You may change that assignment using this control.

Key Path	**Marker, Properties**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe <integer>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?`
Example	CALC:VECT:MARK3:TRAC 2 CALC:VECT:MARK3:TRAC?
Couplings	See Couplings of Delta and Reference Markers above..

Preset	Marker is assigned to currently selected trace when turned on.
State Saved	Saved in instrument state.
Range	Trace 1|Trace2|Trace 3|Trace 4
Min	1
Max	4
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Count

This key enables the frequency counter algorithm on the selected marker. This algorithm can more precisely determine the frequency of a peak. The marker must be on a frequency domain trace, with data coming from hardware. Place the marker on a peak and enable the frequency counter. The marker readout then shows the calculated frequency rather than the marker X position. Only one marker can be counted at any time. Turning on marker count for any marker turns it off for all other markers.

Key Path	**Marker, Properties**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt[:STATe] OFF|ON|0|1` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt[:STATe]?`
Example	CALC:VECT:MARK:FCO ON CALC:VECT:MARK:FCO?
Notes	Marker must be on a frequency-domain trace and data must be live, not recorded or simulated.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off|On
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

The frequency counter result must be read back with the following SCPI command. The Marker X query command will only get the marker's data point position, which will not be as accurate as the frequency counter result.

Key Path	**SCPI only**

Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FCOunt:X?`
Example	CALC:VECT:MARK:FCO:X?
Notes	Query only. If the marker counter result is unavailable, NaN is returned.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Table

When the Marker Table is turned on, the display is split into a measurement window and a marker data display window. For each marker which is on, information is displayed in the data display window, which includes the marker number, control mode, trace number, X axis scale, X axis value, and the Y-axis result. Additional information is shown for markers which have marker functions turned on.

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer:TABLe[:STATe] OFF|ON|0|1` `:CALCulate:<meas>:MARKer:TABLe[:STATe]?`
Example	CALC:VECT:MARK:TABL ON CALC:VECT:MARK:TABL?
Preset	OFF
State Saved	No
Range	Off|On
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Couple Markers

Marker Coupling affects all currently displayed markers. In general when coupling is turned on then all Normal or Delta markers with the same (or equivalent) domain as the selected marker move in the same manner as the selected marker. Coupling is relative between markers on the same trace (so that their relative positions in the domain are maintained). Coupling can be absolute between markers on different traces that have equivalent domains. That is, they are forced have the same position in the domain, if possible. (As an example of equivalent domains, demodulated symbol positions can be derived from time by using the current symbol rate). When you move the selected marker, then others on related traces track it. This is to allow you to correlate different measurement results. For example, to you can place a marker at a particular symbol time on an error vector magnitude display, and have tracking markers on the symbol table and pre-demod time trace, showing you the symbol value and the actual time-varying signal value at the same point in time.

Absolute coupling is performed only for the lowest numbered Normal or Delta marker on each trace. All other markers on a trace couple relatively. When you turn on marker coupling, the subset of markers that have the same domain as the selected marker track it and all other markers remain at their current location. The absolutely coupled markers within this subset will be moved at this time to match the domain setting of the selected marker, with the relatively coupled markers following accordingly to maintain offsets within their respective traces. Those markers with different domains remain at their current location. When you select a marker with a different domain than the previously selected marker, then the subset of markers with that domain go through the same procedure.

Any marker that coupling would move outside its range of X values, will remain at the closest limiting value until the selected marker moves in such a way as to bring the coupled X value back into range. If the coupled markers are on data that do not have the same domain resolution, then they are positioned as close to each other as possible.

If markers change mode or trace, or trace data is changed below them, the coupling rules are immediately applied to the new set.

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer:COUPle[:STATe] OFF|ON|0|1` `:CALCulate:<meas>:MARKer:COUPle[:STATe]?`
Example	CALC:VECT:MARK:COUP ON CALC:VECT:MARK:COUP?
Preset	OFF
State Saved	Saved in instrument state.
Range	Off|On
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

All Markers Off

This function turns all markers off and sets the selected marker to 1.

Key Path	**Marker**
Mode	VSA, LTE, LTETDD, IDEN

Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer:AOFF`
Example	CALC:VECT:MARK:AOFF:
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker -> (Marker To)

The Marker -> hardkey provides access to some convenient functions for copying the marker position to a number of frequency and Y-axis scaling parameters. These functions are available from the front panel only. No SCPI is provided, because you can already read the marker position via SCPI and then set any frequency or scaling parameter accordingly, with full accuracy.

Pressing the Marker -> hardkey always makes the selected marker's X position the active function.

If the selected marker is off, pressing the Marker -> hardkey turns on the selected marker in normal mode on the currently selected trace.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr -> CF (Center Frequency)

This function sets the center frequency equal to the selected marker's absolute frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr -> CF Step

This function sets the center frequency step size equal to the selected marker's frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr -> Start

This function sets the start frequency equal to the selected marker's frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr -> Stop

This function sets the stop frequency equal to the selected marker's frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr Delta -> Span

This function sets the start and stop frequencies to equal to the selected marker's frequency and that of its reference. That is, the measurement span is "zoomed in" so that the selected marker and its associated reference appear on the extreme left and right of the display. The marker must be on a frequency-domain trace and its control mode must be Delta.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr -> Ref Lvl

This function sets the Y axis reference value equal to the selected marker's Y value. For example, if the reference position is at the top of the screen, the whole trace is moved up so that the marker appears at the top of the screen. Note that this is a display scaling function only. The input range remains the same.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Counter -> CF (Center Frequency)

This function copies the frequency of the marker counter to the center frequency. The marker counter function must be on.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr Delta -> CF (Center Frequency)

This function sets the center frequency equal to the difference in frequency between the selected Delta marker and its reference. The marker must be on a frequency-domain trace and the selected marker's control mode must be Delta.

Key Path	**Marker To**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Marker Function

This key accesses a menu of selectable marker functions for VSA based measurements.

Marker Functions perform post-processing operations on marker data. Band Functions are Marker Functions that allow you to define a band of frequencies around the marker. The band defines the region of data used for the numerical calculations. These marker functions also allow you to perform mathematical calculations on trace and marker data and report the results of these calculations in place of the normal marker result.

Unlike regular markers, marker function markers are not placed directly on the trace. They are placed at a location which is relative to the result of the function calculation.

The Marker Function menu gives you access to power calculations in bands of frequencies or time intervals centered on a marker. It also allows you to make calculations like carrier to noise by combining delta markers with marker functions. Marker functions are generally available for time and frequency domain traces, and not for others. If the marker function calculation is undefined for particular trace data, then "---" is shown in place of a number in the result display and marker table, and CALC:<meas>:MARK[n]:Y? will return 9.91E+37 (NaN).

Pressing Marker Function always makes the selected marker's X position the active function.

If the selected marker is off, pressing the Marker Function hardkey turns on the selected marker in normal mode on the currently selected trace.

<table>
<tr><th>Key Path</th><th>Marker Function</th></tr>
<tr><td>Mode</td><td>VSA, LTE, LTETDD, IDEN</td></tr>
<tr><td>Measurement</td><td><meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk</td></tr>
<tr><td>Remote Command</td><td>:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion BPOWer|BDENsity|=OFF
:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion?</td></tr>
<tr><td>Example</td><td>CALC:VECT:MARK1:FUNC BPOW
CALC:VECT:MARK1:FUNC?</td></tr>
<tr><td>Notes</td><td>:CALC:<meas>:MARK1:FUNC? returns the current function type for marker 1. To return the result, use :CALC:<meas>:MARK1:Y?</td></tr>
<tr><td>Preset</td><td>=OFF</td></tr>
<tr><td>State Saved</td><td>Saved in instrument state.</td></tr>
<tr><td>Range</td><td>Band Power|Band Density|Off</td></tr>
<tr><td>Initial S/W Revision</td><td>Prior to A.02.00</td></tr>
<tr><td>Modified at S/W Revision</td><td>A.02.00</td></tr>
</table>

Band/Interval Power

Turns on the Band/Interval Power function for the selected marker. This function calculates the power within the band centered on the marker. The function works generally with frequency spectra, PSD and time traces. On traces where band power is undefined, the result display shows "---" and CALC:<meas>:MARK[n]:Y? will return 9.91E+37 (NaN), although the band interval can still be defined.

Frequency-domain data

If the marker is on a frequency-domain trace, the result is total power within the band. This is true whether the underlying trace data is a power spectrum or power spectral density.

Time-domain data

If the marker is on a time-domain trace, the result is average power within the time interval, that is, the power at each time sample in the time interval is calculated, the powers are summed and the total divided by the number of samples.

Key Path	**Marker Function**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band Power Calculation

A band/interval power calculation result may be shown in dBm, dBVrms, Watts, Volts RMS Squared or Volts RMS. The table below shows the choice of display units if Band Power Calculation is set to Mean, depending on the current format and Y units of the trace the marker is on.

Trace data type	Trace Format	Y Unit	Result format
Spectrum, PSD, Time record	LogMag (dB)	Auto, Power	dBm
		Peak, RMS	dBVrms
		mRMS	dBmVrms
	Linear Mag, Real, Imag, Log Mag (lin)	Auto, Peak, RMS, mRMS	Vrms^2
	Linear Mag, Real, Imag, Log Mag(lin)	Power	W
	Wrap Phase, Unwrap Phase, Delay	Any	Vrms^2
	Vector, Constellation, Eye, Trellis	Any	blanked
Dimensionless (e.g., Frequency response, Impulse response, various Demodulation error types)	LogMag (dB)	Any	dBrms
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	Any	rms^2
General dimensions(e.g., Hz, %)	LogMag (dB)	Any	dB<unit>rms
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	Any	<unit>rms^2

If the Band Power Calculation is set to RMS, then the readout unit does not depend on trace format or Y unit. For Spectrums, PS and Time record traces the displayed unit is "Vrms" For general units, the unit abbreviation is shown followed by "rms".

The Band Power Calculation only controls the readout format for Normal and Fixed markers. For Delta markers, see the discussion below.

Key Path	**Marker Function, Band/Interval Power**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BPOWer:CTYPe MEAN|RMS` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BPOWer:CTYPe?`
Example	CALC:VECT:MARK1:FUNC:BPOW:CTYP MEAN CALC:VECT:MARK1:FUNC:BPOW:CTYP?
Preset	MEAN
State Saved	Saved in instrument state.
Range	Mean|RMS
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band/Interval Density

This function calculates the average power density within the band centered on the marker. The function works generally with frequency spectra, PSD and time traces. On traces where band power cannot reasonably be defined, the result display shows "---" and CALC:<meas>:MARK[n]:Y? returns NaN (9.91E+37), although the band interval can still be defined.

Frequency-domain data

If the marker is on a frequency-domain trace, the result is the band power (as computed above) divided by the bandwidth over which it is measured. This is true whether the underlying trace data is a power spectrum or power spectral density.

Time-domain data

If the marker is on a time-domain trace, the result is average power within the time interval (as computed above) divided by the equivalent noise bandwidth of the span.

Key Path	**Marker Function**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band Density Calculation

Turns on the Band/Interval Density function for the selected marker. If the selected marker is off, it is turned on in **Normal** marker mode and located at the center of the screen.

When **Band/Interval Density** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

If the detector mode for the detector on the marker's trace is set to Auto, the average detector is selected. If the Average type is set to Auto, Power Averaging is selected. Other choices for the detector or Average type will usually cause measurement inaccuracy.

A band/interval density calculation result may be shown in dBm/Hz, Volts RMS Squared or Volts RMS. The table below shows the choice of display units if **Band Density Calculation** is set to **Mean**, depending on the current format of the trace the marker is on.

Trace data type	Trace Format	Result format
Spectrum, PSD, Time record	LogMag (dB)	dBm/Hz
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	Vrms^2/Hz
Dimensionless (e.g., Frequency response, Impulse response, various Demodulation error types)	LogMag (dB)	dBrms/Hz
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	rms^2/Hz
General dimensions(e.g., Hz, %)	LogMag (dB)	dB<unit>rms/Hz
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	<unit>rms^2/Hz

If the **Band Density Calculation** is set to **RMS**, then the readout unit does not depend on trace format. For Spectrum, PSD and Time record traces the displayed unit is "Vrms/rtHz" For general units, the unit abbreviation is shown followed by "rms/rtHz ".

The Band Density Calculation only controls the readout format for Normal and Fixed markers. For Delta markers, see the discussion below.

Key Path	**Marker Function, Band/Interval Power**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BDENsity:CTYPe MEAN|RMS` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BDENsity:CTYPe?`

Example	CALC:VECT:MARK1:FUNC:BDEN:CTYP RMS CALC:VECT:MARK1:FUNC:BDEN:CTYP?
Preset	MEAN
State Saved	Saved in instrument state.
Range	Mean|RMS
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band Adjust

These keys allow you to define the bandwidth around the marker. The band is always centered on the marker position. Entering the menu always sets Band/Interval Span as the active function

Key Path	**Marker Function**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band/Interval Center

This function defines the center of the band. That is, it allows you to adjust the marker position in absolute units (regardless of whether the marker mode is Normal or Delta).

Key Path	**Marker Function, Band Adjust**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:CENTer <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:CENTer?`
Example	CALC:VECT:MARK2:FUNC:BAND:CENT 1.23E+09 CALC:VECT:MARK2:FUNC:BAND:CENT?
Preset	Center of screen
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00

Band/Interval Span

Sets the width of the span for the selected marker. This function defines the span of frequencies or time. The marker position does not change when you adjust the span.

Key Path	**Marker Function, Band Adjust**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:SPAN <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:SPAN?`
Example	CALC:VECT:MARK2:FUNC:BAND:SPAN 1.23E+06 CALC:VECT:MARK2:FUNC:BAND:SPAN?
Preset	When marker turned on, 1/20th of current span or displayed time length
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band/Interval Left

This function adjusts the left side of the band. In order to remain centered in the band, the marker position must also change as you change the left edge. The right edge is unaffected.

Key Path	**Marker Function, Band Adjust**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:LEFT <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:LEFT?`
Example	CALC:VECT:MARK2:FUNC:BAND:LEFT 1.23E+06 CALC:VECT:MARK2:FUNC:BAND:LEFT?
Couplings	Changes marker X to keep the marker centered in the band

Preset	When marker turned on, 1/40th of current span or displayed time length left of the marker position
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band/Interval Right

This function adjusts the right side of the band. In order to remain centered in the band, the marker position must also change as you change the right edge. The left edge is unaffected.

Key Path	**Marker Function, Band Adjust**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:RIGHt <real>` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:RIGHt?`
Example	CALC:VECT:MARK2:FUNC:BAND:RIGHT 1.23E+06 CALC:VECT:MARK2:FUNC:BAND:RIGHT?
Couplings	Changes marker X to keep the marker centered in the band
Preset	When marker turned on, 1/40th of current span or displayed time length right of the marker position
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Band Power and Delta Markers

When either a Delta marker or its reference has a band power function turned on, the Delta marker readout always shows a ratio calculation. This allows you to perform common calculations like carrier to noise ratio or adjacent channel power ratio. The form of the ratio depends on the main marker function calculation type (Mean or RMS). If the main marker function calculation type is Mean, then when you change the marker to Delta the result will be a power ratio. If the main marker function calculation type is RMS, then the Delta marker result will be a voltage ratio. (If the main marker band power function is off, then the form of the ratio depends on the reference marker calculation type: If it is Mean you get a power ratio, and if it is RMS you get a voltage ratio.)

For example, if the main marker function is Band/Interval Power with a calculation type of Mean and the reference marker function is Band/Interval Power with a calculation type of RMS, then the Delta marker will show the ratio of the main marker “Band/Interval Power Mean” value to the reference marker “Band/Interval Power Mean” (not RMS) value.

A dimensionless ratio (for example Volt/Volt or Watt/Watt) is shown with units of "x". The marker function calculation type will tell you whether the ratio is voltage or power (see above). A dimensionless power ratio is shown with units of dB if the trace format is Log Mag (dB)

If the reference marker function is Band/Interval Density and the main marker is either Band/Interval Power or its function is turned off, then the ratio is not dimensionless, but has units of Hz (or dB-Hz) for power calculations, or rtHz for voltage calculations. When the main marker function is Band/Interval Density and the reference is either Band/interval Power or its function is off, the units are /Hz (or dB/Hz) for power calculations, or /rtHz for voltage calculations.

Key Path	**Marker Function**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Meas Setup

This key accesses a menu of keys that select measurement functions for VSA based Measurements.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Avg Number

This key allows you to turn averaging on or off, and set the number of scans (time records) whose measurement results will be averaged. Averaging can be done over spectrum results (RMS) or over time records (Time). A third kind of pseudo averaging displays the maximum value seen at each spectral line over the specified number of scans. See Average Type for a more detailed description of how measurement results are averaged.) For RMS or Time averaging, the process is similar. Each time an averaged result is displayed, it is the sum of the individual results taken since measurement restart, divided by the number of scans. (For Max averaging, there is no actual summation or division.) The Measurement Bar shows the number of scans and the Avg number setting; for example, if 4 scans have been taken and the Avg Number is 10, the Meas Bar shows "4/10". The measurement continues to take new scans until the number of scans is equal to the Avg Number setting, at which time the measurement stops if Sweep control is in Single Mode. Otherwise, the measurement continues, and the Average Mode setting determines how successive scans are added to the averaged result. See the Average Mode topic for details.

Key Path	**Meas Setup, More**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`[:SENSe]:<meas>:AVERage:COUNt <integer>`
	`[:SENSe]:<meas>:AVERage:COUNt?`
	`[:SENSe]:<meas>:AVERage[:STATe] OFF|ON|0|1`
	`[:SENSe]:<meas>:AVERage[:STATe]?`

Example	VECT:AVER:COUN 20 VECT:AVER:COUN? VECT:AVER ON VECT:AVER?
Notes	If an averaged measurement is idle because the scan count is equal to the Avg Number, and the Avg Number is increased, the measurement will resume until the new number of averages is satisfied.
Preset	10 OFF IPOW: ON
State Saved	Saved in instrument state.
Min	1
Max	2147483647
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Average Mode

The Average Mode determines what happens when the Sweep Mode is Continuous and the number of scans processed exceeds the Average Number (see above). If the Sweep Control is in Single mode, this setting has no effect.

When averaging is on and the number of scans is less than or equal to the Avg Number setting, a linear average is calculated as explained in the Avg Number topic. After the scan count exceeds the Avg Number setting, the measurement continues to take new scans. The Measurement Bar average indicator shows ">N/N" where N is the Avg Number.

If Average Mode is Exp then new results are averaged in exponentially. In other words, each succeeding average will be the weighted sum of the previous average, weighted by (N–1)/N, and the new measurement, weighted by 1/N, where N is the Average Number setting. (For Max averaging, no weighting occurs; the result continues to be the max value seen at each spectral line for every previous scan since measurement restart.)

If Average Mode is Repeat, then the average buffer will be cleared after the average counter reaches the Average Number setting, and the average counter will be reset to 0. Then a new set of averages is taken. The measurement bar therefore continues to show "k/N" in the average indicator, where k is the number of scans since the last time the average buffer was cleared and N is the Avg Number. The averaged result is the sum of the last k results divided by k. (For Max averaging, no sum or division takes place, but the buffer is cleared as stated above. The averaged result is the max value seen over the last k scans.)

Key Path	**Meas Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`[:SENSe]:<meas>:AVERage:TCONtrol EXPonential|REPeat` `[:SENSe]:<meas>:AVERage:TCONtrol?`
Example	VECT:AVER:TCON EXP VECT:AVER:TCON?
Preset	EXP
State Saved	Saved in instrument state.
Range	Exp|Repeat
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Average Setup

This key accesses a menu allowing you to set Averaging parameters for all VSA based measurements.

Key Path	**Meas Setup**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Average Type

The Average Type key allows you to select the type of averaging. The table below shows what measurement results are averaged for each average type. This applies in the Vector Measurement. For the other measurements, details of additional results that is averaged will be given in the measurement PD.

Average Type	Measurement result averaged
RMS	Spectrum, PSD: Power is averaged for each spectral line (i.e., this is a mean-square average of voltage). For the Spectrum result only, if the display transform is linear or real, the RMS result is displayed.
Time	Main Time: Individual time samples in the current time record are averaged vectorially (not RMS) with corresponding points in previous time records. See “Main Time” on page 434 for more details.
Max	Spectrum, PSD: Not strictly an average. For each spectral line, power from the current measurement is compared to the average buffer value and the maximum is kept in the average buffer.

Some measurement results are inherently averaged, and are not affected by the Average controls. These are: CCDF, CDF, and PDF. They average continuously until the next measurement restart.

Key Path	**Meas Setup, Average Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`[:SENSe]:<meas>:AVERage:TYPE RMS|TIME|MAXimum` `[:SENSe]:<meas>:AVERage:TYPE?`
Example	VECT:AVER:TYPE RMS VECT:AVER:TYPE?
Preset	RMS
State Saved	Saved in instrument state.
Range	RMS|Time|Max
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Fast Average

Fast average controls the display of average data. If fast averaging is off, then the display is updated after each time record is processed. If fast averaging is on, then the display is only updated after every M records, where M is the Update Rate (see below). For example, if the fast average count is 10, then the running average is only displayed every 10th time record.

Key Path	**Meas Setup, Average Setup**
Mode	VSA, LTE, LTETDD, IDEN

Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`[:SENSe]:<meas>:AVERage:FAST OFF|ON|0|1` `[:SENSe]:<meas>:AVERage:FAST?`
Example	VECT:AVER:FAST ON VECT:AVER:FAST?
Preset	OFF
State Saved	Saved in instrument state.
Range	On|Off
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Update Rate

The Update Rate controls how often the display updates when fast averaging is turned on. If the Fast Averaging State is MAX then the display is updated only after the full Average Count is reached. Otherwise, the display is updated whenever the average count is a multiple of the Update Rate..

Key Path	**Meas Setup, More, Average Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`[:SENSe]:<meas>:AVERage:FAST:URATe <integer>`
	`[:SENSe]:<meas>:AVERage:FAST:URATe?`
	`[:SENSe]:<meas>:AVERage:FAST:URATe:AUTO OFF|ON|0|1`
	`[:SENSe]:<meas>:AVERage:FAST:URATe:AUTO?`

Example	VECT:AVER:FAST:URAT 20 VECT:AVER:FAST:URAT? VECT:AVER:FAST:URAT:AUTO ON VECT:AVER:FAST:URAT:AUTO?
Preset	10 ON
State Saved	Saved in instrument state.
Min	1
Max	2147483647
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00

PhNoise Opt

Allows you to adjust the LO phase noise optimization to give better close-in phase noise, or better wide-offset phase noise. The definition of what frequency offsets constitute close in or wide offset varies with hardware. (The selection keys provide hardware-specific prompts.)

Key Path	**Meas Setup**
Mode	VSA, WIMAXFIXED
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM
Remote Command	[:SENSe]:<meas>:FREQuency:SYNThesis[:STATe] 1|2 [:SENSe]:<meas>:FREQuency:SYNThesis[:STATe]?
Example	VECT:FREQ:SYNT 1 VECT:FREQ:SYNT?
Preset	all VXAmeasurements: Best Wide-offset Φ Noise WIMAXFIXED EVM measurement: Best Close-in Φ Noise
State Saved	Yes
Notes	Parameter key: 1 - optimizes phase noise for close-in frequencies 2 - optimizes phase noise for wide-offset frequencies The softkey shows the options more explicitly. For MXA/EXA, the selection keys show the options: Best Close-in Φ Noise [offset < 20 kHz] Best Wide-offset Φ Noise [offset > 30 kHz] For PXA the options are: Best Close-in Φ Noise [offset < 180 kHz] Best Wide-offset Φ Noise [offset > 210 kHz]
Initial S/W Revision	A.04.00

Best Close-in Φ Noise

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out. For MXA, close in means offsets < 20 kHz; for PXA, it means offsets < 140 kHz.

Key Path	**Meas Setup, PhNoise Opt**
Mode	VSA, WIMAXFIXED

Example	VECT:FREQ:SYNT 1 VECT:FREQ:SYNT?
Modified at S/W Revision	A.04.00

Best Wide-offset Φ Noise

The LO phase noise is optimized for wider offsets from the carrier, at the expense of phase noise closer in. For MXA, wide-offset means offsets > 30 kHz; for PXA, it means offsets > 160 kHz.

Key Path	**Meas Setup, PhNoise Opt**
Mode	VSA, WIMAXFIXED
Example	VECT:FREQ:SYNT 2 VECT:FREQ:SYNT?
Modified at S/W Revision	A.04.00

Peak Search

The Peak Search hardkey displays a menu that allows markers to be easily moved among peaks on a trace, and also performs the peak search function, as described below. Pressing Peak Search also makes the selected marker's X position the active function.

The peak search function causes the marker to move to the highest point in the trace. The highest point is the point with the largest y-axis value in the current trace format. If the format is complex (vector or constellation) then the point with the highest magnitude is chosen.

Pressing the Peak Search hard key always performs a Peak Search, with one exception: if the Peak Search menu is not showing but the selected marker is on (Normal, Delta, or Fixed), then pressing the Peak Search hardkey only displays the Peak Search menu. This allows you to select one of the other peak search functions without disturbing the selected marker's position. If you want to perform a peak search in this case, press the Peak Search hardkey again.

If the selected marker is Off, then pressing the Peak Search hardkey once not only shows the menu, but it turns on the selected marker in Normal mode, assigns it to the selected trace, and performs a peak search.

If any peak search SCPI command is invoked on a marker that is Off, the marker is first turned on in Normal mode and assigned to the selected trace. Then the peak search is performed.

Key Path	**Peak Search (press hardkey twice if menu is not showing)**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum`
Example	CALC:VECT:MARK2:MAX

<table>
<tr><td>Notes</td><td>There is no softkey for this function. Instead, you press the Peak Search hardkey twice. (Pressing it once is sufficient if the Peak Search menu is showing, but twice guarantees that the function will be invoked)

If peak search function is not invoked (because the response to pressing the hardkey was only to show the menu) then the following message is shown: "Press Peak Search again to perform a Peak Search."</td></tr>
<tr><td>Initial S/W Revision</td><td>Prior to A.02.00</td></tr>
<tr><td>Modified at S/W Revision</td><td>A.02.00</td></tr>
</table>

Next Peak (Next Lower Amptd)

This command moves the marker to the peak next lower in Y value than the peak it is currently on. If the format is complex (vector or constellation) then the marker moves to the closest point that has a lower magnitude than the marker's current position. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

<table>
<tr><td>Key Path</td><td>Peak Search</td></tr>
<tr><td>Mode</td><td>VSA, LTE, LTETDD, IDEN</td></tr>
<tr><td>Measurement</td><td><meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk</td></tr>
<tr><td>Remote Command</td><td><code>:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum:NEXT</code></td></tr>
<tr><td>Example</td><td>CALC:VECT:MARK2:MAX:NEXT</td></tr>
<tr><td>Initial S/W Revision</td><td>Prior to A.02.00</td></tr>
<tr><td>Modified at S/W Revision</td><td>A.02.00</td></tr>
</table>

Next Higher Amptd

This command moves the marker to the peak next higher in Y value than the peak it is currently on. . If the format is complex (vector or constellation) then the marker moves to the closest point that has a higher magnitude than the marker's current position. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

<table>
<tr><td>Key Path</td><td>Peak Search</td></tr>
<tr><td>Mode</td><td>VSA, LTE, LTETDD, IDEN</td></tr>
<tr><td>Measurement</td><td><meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk</td></tr>
<tr><td>Remote Command</td><td><code>:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum:PREVious</code></td></tr>
<tr><td>Example</td><td>CALC:VECT:MARK2:MAX:PREV</td></tr>
<tr><td>Initial S/W Revision</td><td>Prior to A.02.00</td></tr>
</table>

Modified at S/W Revision	A.02.00

Next Right

This command moves the marker to the next peak to the right of its current position. If the format is complex (vector or constellation) then the marker moves forward in time to the next peak. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

A valid peak is one for which the displayed Y-axis values drop monotonically on both sides of the local maximum at least 4% of the distance between the top and bottom of the display grid before the values begin to rise again.

Key Path	**Peak Search**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum:RIGHt`
Example	CALC:VECT:MARK2:MAX:RIGH
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Next Left

This command moves the marker to the next peak to the left of its current position. If the format is complex (vector or constellation) then the marker moves back in time to the next peak. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

A valid peak is one for which the displayed Y-axis values drop monotonically on both sides of the local maximum at least 4% of the distance between the top and bottom of the display grid before the values begin to rise again.

Key Path	**Peak Search**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MAXimum:LEFT`
Example	CALC:VECT:MARK2:MAX:LEFT
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr -> CF (Center Frequency)

This key is a duplicate of the key of the same name in the Mkr -> menu. It is placed in this menu as a convenience. See the description in the Marker To section.

Key Path	**Peak Search**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Continuous Peak Search

This key turns on Continuous Peak Search for the selected marker. This function be turned on for any marker independently of any other marker. This function moves the marker to the highest point on the trace each time the trace is updated. If the SCPI command refers to a marker that is off, it is turned on in Normal mode.

It is possible to have Couple Markers and Continuous Peak Search both on. If this is the case, it is recommended that Continuous Peak search be turned on for only one marker in any tracking set (that is, any set of markers with the same or equivalent domain). Otherwise, conflicts over marker position may arise that cause erratic marker movement.

Key Path	**Peak Search**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:CPSearch[:STATe] ON|OFF|1|0` `:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:CPSearch[:STATe]?`
Example	CALC:VECT:MARK1:CPS ON
Couplings	The Continuous Peak Search key is grayed out when the selected marker is a **Fixed** marker. Also, if Continuous Peak Search is on and the selected marker becomes a fixed marker, then Continuous Peak Search is turned off and the key grayed out. Continuous Peak Search is turned off when the selected marker is turned off.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off|On
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Min Search

This command moves the marker to the lowest Y value on the trace. If the format is complex (vector or constellation) then the marker moves to the lowest value in magnitude. If the SCPI command refers to a marker that is off, it is first turned on in Normal mode and then set on the minimum point.

Key Path	**Peak Search**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:MINimum`
Example	CALC:VECT:MARK2:MIN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Mkr -> Ref Lvl (Reference Level)

This function sets the Y axis reference value equal to the selected marker's Y value. For example, if the reference position is at the top of the screen, the whole trace is moved up so that the marker appears at the top of the screen. Note that this is a display scaling function only. The input range remains the same.

Key Path	**Peak Search**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Recall

Operation of this key is identical across several measurements. For more details about this key, see “Recall” on page 139.

State

Key Path	**Recall**
Mode	VSA, LTE, LTETDD, IDEN

Data (Import)

Key Path	**Recall**

Mode	VSA, LTE, LTETDD, IDEN

Import Trace Data

This selection allows you to import previously saved trace data into a Data Register and optionally display it. Selecting this key displays a menu that allows you to select the destination data register, and also allows you to choose whether or not to display the recalled data in the currently selected trace. After making these selections depress Open… and use the file dialog to select the file you wish to recall.

Recalling trace data into an already used Data Register overwrites the previous data. If the data register is displayed on any trace, the display is updated to reflect the new data.

The SCPI command

:MMEM:LOAD:TRAC:DATA D1|D2|D3|D4|D5|D6,<filename>

recalls data into a specified register, but does not display it in the selected trace. Use the command

:DISP:<meas>:TRAC<n>:FEED D1|D2|D3|D4|D5|D6

to display the register in the desired trace.

It is possible to recall trace data saved by other VXA measurements, or measurements made using the LTE, LTETDD, iDEN, or 89601 applications.

Key Path	**Recall, Data (Import)**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:MMEMory:LOAD:TRACe:DATA D1|D2|D3|D4|D5|D6,<filename>[,CSV|TXT|SDF|MAT4|MAT|HDF5|BIN]`
Example	:MMEM:LOAD:TRAC:DATA D1,"Trc1.txt",TXT
Notes	The Open: dialog box has the following filter options when you are recalling trace data:: • CSV (Comma delimited) (*.csv) • SDF (Fast) (*.sdf;*.dat) • Text (Tab delimited) (*.txt) The file must have the same format as that created by the Export Recorded Data command. The SCPI command has an optional file format parameter. If you do not include this parameter in the SCPI command, the file format is determined by the file name extension. If no file extension is recognized, the file is scanned to determine the format. If you are not licensed to recall a particular file type, then error –203.9010 will be returned. If the file format cannot be determined or the file cannot be recalled successfully, then error –250.5290 is returned. If the recall is successful, then advisory 0.1600 is shown.
State Saved	No

Readback	Data 1|Data 2|Data 3|Data 4|Data 5|Data 6

Data 1

Selects the Data 1 register as the destination for the imported data

Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA, LTE, LTETDD, IDEN

Data 2

Selects the Data 2 register as the destination for the imported data

Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA, LTE, LTETDD, IDEN

Data 3

Selects the Data 3 register as the destination for the imported data

Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA, LTE, LTETDD, IDEN

Data 4

Selects the Data 4 register as the destination for the imported data

Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA, LTE, LTETDD, IDEN

Data 5

Selects the Data 5 register as the destination for the imported data

Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA, LTE, LTETDD, IDEN

Data 6

Selects the Data 6 register as the destination for the imported data

Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA, LTE, LTETDD, IDEN

Display in Selected Trace

Allows you to select whether the recalled trace data is to be displayed in the current Trace.

Key Path	**Recall, Data (Import), Trace (to)**
Mode	VSA, LTE, LTETDD, IDEN
State Saved	No

Open …

Key Path	**Recall, Data (Import)**
Mode	VSA, LTE, LTETDD, IDEN

Save

See “Save” on page 155 in the section "Common Measurement Functions" for more information.

State

Key Path	**Save**
Mode	VSA, LTE, LTETDD, IDEN

Data (Export)

Key Path	**Save**
Mode	VSA, LTE, LTETDD, IDEN

Export Trace Data

This selection allows you to export trace data with (optional) associated headers. Selecting this key displays a menu that allows you to choose which Trace to save (default is the selected Trace) and whether or not to save headers with the data. The header information is used by the VXA application when saved trace data is recalled, and allows it to be displayed with the same formatting and scaling that it had when saved. If headers are not saved, the scaling and format are set to default values when the trace is recalled. After making these selections, press Save As… and use the file dialog to choose a file name and format for the saved data.

Trace data may be exported in several different formats. Text and comma-separated variable (CSV) formats are useful for viewing the data or importing it to a spreadsheet program. The other formats are binary and thus more compact. Trace data files may be recalled for viewing into other VXA, LTE, LTETDD, iDEN, or 89601 measurements.

Key Path	**Save, Data (Export)**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:MMEMory:STORe:TRACe:DATA TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,"<filename>"[,CSV|TXT|SDF|MAT4|MAT|HDF5|BIN[,OFF|ON|0|1]]`
Example	:MMEM:STOR:TRAC:DATA TRACE1,"TRC1.TXT",TXT,ON
Notes	The Save As… dialog box has the following format options when you are saving trace data: • CSV (Comma delimited) (*.csv) • SDF (Fast) (*.sdf;*.dat) • Text (Tab delimited) (*.txt) File format saved depends on selection. The appropriate file extension is appended to the filename if it is not supplied by the user. If the SCPI command includes just a file name, the file format is determined by the filename extension, which must be one of the choices above. *.sdf, or an unrecognized extension chooses the SDF fast format. If the optional file format enumerator is included in the command, then this determines the file format and the file extension is ignored. The optional binary parameter determines if file headers are saved. The default is ON. If file headers are not wanted use the optional ",OFF" parameter. The optional Boolean parameter determines whether headers are saved in the file. By default the headers are saved. If you are not licensed to save a particular file type, then error –203.9010 will be returned.If an invalid file format is specified or the file cannot be saved successfully, then error –25x is returned. If the save is successful, then advisory 0.1500 is shown.
State Saved	No
Readback	(Trace 1|Trace 2|Trace 3|Trace 4|Trace 5|Trace 6)(with|without) headers

Trace 1

Selects the Trace 1 register as the destination for the imported data

Key Path	**Save, Data (Export), Trace**
Mode	VSA, LTE, LTETDD, IDEN

Trace 2

Selects the Trace 2 register as the destination for the imported data

Key Path	**Save, Data (Export), Trace**

Mode	VSA, LTE, LTETDD, IDEN

Trace 3

Selects the Trace 3 register as the destination for the imported data

Key Path	**Save, Data (Export), Trace**
Mode	VSA, LTE, LTETDD, IDEN

Trace 4

Selects the Trace 4 register as the destination for the imported data

Key Path	**Save, Data (Export), Trace**
Mode	VSA, LTE, LTETDD, IDEN

Trace 5

Selects the Trace 5 register as the destination for the imported data

Key Path	**Save, Data (Export), Trace**
Mode	VSA, LTE, LTETDD, IDEN

Trace 6

Selects the Trace 6 register as the destination for the imported data

Key Path	**Save, Data (Export), Trace**
Mode	VSA, LTE, LTETDD, IDEN

Include Header

Allows you to select whether or not the saved trace data includes header information describing scaling, formatting, etc.

Key Path	**Save, Data (Export), Trace**
Mode	VSA, LTE, LTETDD, IDEN
State Saved	No

Save As . . .

Key Path	**Save, Data (Export)**
Mode	VSA, LTE, LTETDD, IDEN

Screen Image . . .

Key Path	**Save**
Mode	VSA, LTE, LTETDD, IDEN

SPAN X Scale

This menu has softkeys for selecting measurement span and also for scaling of the X axis.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Span

This controls the frequency span of the measurement. This is the full span that is displayed on a spectrum display. The actual IF bandwidth that the time record sees is 1.28 times the span. See the FREQ Channel section for details on how this interacts with start, stop, and center frequencies.

Key Path	**SPAN/XScale**
Mode	VSA, IDEN
Remote Command	`[:SENSe]:FREQuency:SPAN <freq>` `[:SENSe]:FREQuency:SPAN?`
Example	FREQ:SPAN 10 MHZ FREQ:SPAN?
Couplings	Start Freq and Stop Freq. See narrative under FREQ Channel heading for details.
Preset	depends on span option
State Saved	Saved in instrument state.
Min	2 Hz
Max	depends on span option
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Full Span

This immediate action key changes the span to the maximum available. The center frequency remains unchanged, regardless of whether the Frequency Annotation property is Start/Stop or Center/Span.

Key Path	**SPAN/XScale**
Mode	VSA, IDEN
Remote Command	`[:SENSe]:FREQuency:SPAN:FULL`
Example	FREQ:SPAN:FULL
Notes	The label on the softkey gives the full span available, which depends on span option.
Couplings	Changes span to maximum while keeping the center frequency constant. Start and Stop frequency are affected
Readback Text	[25 MHz] If playing back a recording, list the recorded bandwidth here
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Signal Track

From the point of view of a spectrum display, this function, when turned on, attempts to keep the largest magnitude signal in the center of the screen. It is the equivalent of manually doing a single acquisition, doing a marker to peak search on a spectrum trace, then copying the marker position to the center frequency and repeating. (It is not necessary to be viewing a spectrum display for this function to work.)

Key Path	**SPAN/XScale**
Mode	VSA
Remote Command	`[:SENSe]:VECTor|ADEMod:FREQuency:CENTer:TRACk OFF|ON|0|1` `[:SENSe]:VECTor|ADEMod:FREQuency:CENTer:TRACk?`
Example	VECT:FREQ:CENT:TRAC ON VECT:FREQ:CENT:TRAC?
Couplings	Unavailable if averaging is turned on.
Preset	0
State Saved	Saved in instrument state.
Range	On | Off
Initial S/W Revision	Prior to A.02.00

X Axis Scaling

By default, the X axis of a trace is scaled to show all the available data in the trace. (The exception is that in spectrum displays, the edges of the spectrum that may contain aliases are not shown by default.) However, the X axis can be manually scaled in order to zoom in on a subset of the X values, or to set the X scaling to more convenient numbers. X scaling may be changed even when a measurement is paused or completed, and the display will be updated immediately, using the existing trace data. No measurement parameters are affected and no new measurement is made. X scaling is unique to each trace.

Scaling is based on a reference position, which may be on the left of the grid, in the center, or on the right. The X reference value is assigned to this position. The X Width is the difference between the X value on the right side of the grid and the X value on the left. If the reference is in the center, the right and left are half of the X width away.

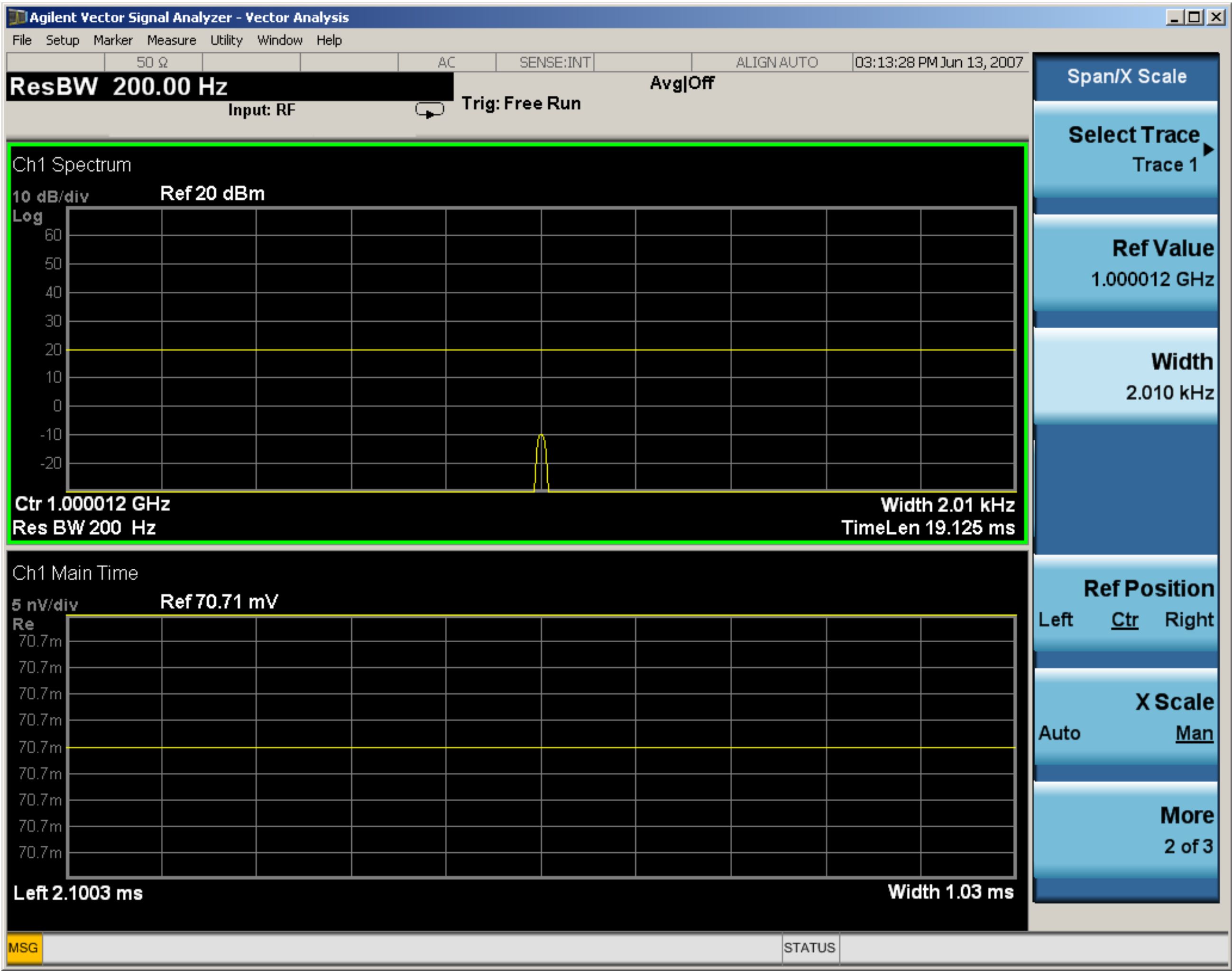
If X scaling is set such that the left or right axis boundary falls outside the X range of the available data, the trace is shown correctly on that portion of the display where it belongs.

For Vector displays (I-Q and Constellation) the X axis is actually perpendicular to the screen, and the screen's horizontal axis is used for the real part of the Y values. In this case, the X scaling can still be used to only display a portion of the data. In the case of the X reference position, left means the least positive or most negative X value, and right means the most positive or least negative value. For example, when looking at a 10 ms time record of a QPSK signal, you could set the X reference position to left, the X reference value to 4 ms and the X width to 1 ms in order to see just the portion of the signal between 4 and 5 ms. This same portion would be shown if IQ format were chosen (even though the time axis is not visible in this case).

For Symbol tables, which are not graphed but displayed in alphanumerics, X scaling can also be used to display a portion of the complete data. For example, you can set the X reference position to left, the X reference value to 20 symbols, and the X width to 10 symbols to see symbols 20 through 30. If then change the X reference position to center, you will see symbols 15 through 25, and if you change the X reference position to right you will see symbols 10 through 20.

Annotation for the X axis is just below the grid on the left and right side. It is based on whether the X Scaling is Auto or Man. If it is Auto, then the left side is annotated with either "Center" or "Start", and the right side is annotated with either "Span" or "Stop" followed by the appropriate numbers and units. The Center/ Span pair is only used for Spectrum or PSD traces, and only if the Freq Annotation property is Center/Span (see Freq Annotation under the FREQ key).

If X Scaling is Man, the annotation for the left side is "Left|Ctr|Right <x_reference_value> <unit>" (depending on the X reference position), and on the right side the annotation is "Width <x_width> <unit>". Shown below is an illustration of two of these manual X scale annotations:



For Vector displays, the X axis annotation is replaced by annotation for the real part of the Y value, each annotation consisting of number followed by a unit (usually volts).

Key Path	**SPAN X Scale**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Select Trace

This function is a duplicate of the same function found on the Trace/Detector menu. See the description there for details. It is placed here to allow you to conveniently choose which trace the X scaling applies.

Key Path	**SPAN X Scale, X Axis Scaling**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00

X Scale

If this function is set to Auto, it causes the trace to display all available trace data. (Exception: the display of the outer edges of a spectrum which may contain aliases is governed by the All Frequency Points function setting – see below.). The annotation is updated as needed, but the X Reference Value and X Width keys are grayed out and not updated. When this function is set to Man, the X Reference Value and X Width softkey readbacks are updated with the current values.

Key Path	**SPAN/XScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:COUPle OFF|ON|0|1` `:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:COUPle?`
Example	:DISP:VECT:TRAC1:X:COUP ON DISP:VECT:TRAC1:X:COUP?
Couplings	Forced to Man if X Reference Value or X Width is set by user.
Preset	1
State Saved	Saved in instrument state.
Range	Auto | Man
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

X Reference Value

This function controls the X value of the selected trace at the chosen X Reference Position (see below). It has no effect on hardware input settings.

Key Path	**SPAN/XScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:RLEVel <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:RLEVel?`
Example	DISP:VECT:TRAC:X:RLEV 1e9 DISP:VECT:TRAC:X:RLEV?

Couplings	If X Scale is set to Auto, the X Reference Value is determined by the trace data and this key is grayed out.
Preset	Depends on trace
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

X Width

This sets the width of the X axis that is displayed for the selected trace. The X width may be set less than the Span for frequency-domain traces, allowing you to zoom in on just a portion of the measured values. Likewise it may be less than time span covered by time-domain data This plus the X Reference Value and X Reference Position control the range of X values that may be displayed on a trace. For example, if the X Reference position is Center, the X Reference value is 1 GHz and the X Width is 20 MHz.

Key Path	**SPAN/XScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:SPAN <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:SPAN?`
Example	DISP:VECT:TRAC:X:SPAN 10e6 DISP:VECT:TRAC:X:SPAN?
Couplings	If X Scale is set to Auto, the X Width is determined by the trace data and this key is grayed out.
Preset	Depends on trace
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

X Reference Position

This determines the position from which the X scaling is calculated for the selected trace. It may be set to the left side, center, or right side of the grid.

Key Path	**SPAN/XScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:RPOSition LEFT|CENTer|RIGHt` `:DISPlay:<meas>:TRACe[1]|2|3|4:X[:SCALe]:RPOSition?`
Example	DISP:VECT:TRAC1:X:RPOS LEFT DISP:VECT:TRAC1:X:RPOS?
Couplings	If X Scale is set to Auto, the X Reference Position is determined by the trace data and this key is grayed out.
Preset	CENT
State Saved	Saved in instrument state.
Range	Left|Ctr|Right
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

All Frequency Points

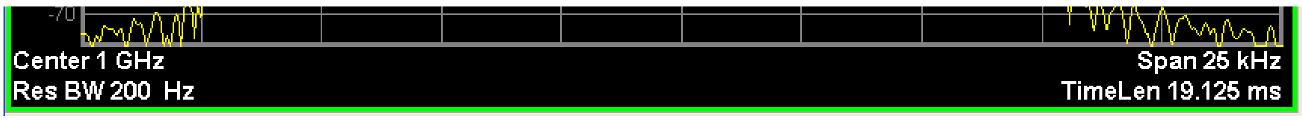
Spectrum trace data (and PSD) are based on the FFT algorithm. By default, the outer edges of the spectrum are not displayed because they may show spurious results that are aliases of real signals that are not completely filtered out by the IF filter. For example, in the case of a 1024 point FFT only 801 points are displayed. If you want to view the additional FFT points at the edges of spectral displays, turn this function on. It is global to all traces, not specific to a single trace.

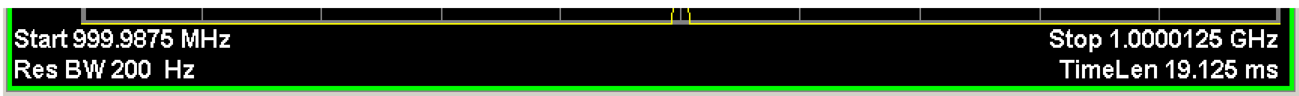
Key Path	**SPAN/XScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:AFPoints OFF|ON|0|1` `:DISPlay:<meas>:AFPoints?`
Example	DISP:VECT:AFP ON DISP:VECT:AFP?
Notes	ac
Couplings	Only applies if trace is showing Spectrum or PSD results.
Preset	OFF

State Saved	Saved in instrument state.
Range	On | Off
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Freq Annotation

This controls how Spectrum and PSD traces are annotated when their X Scale is set to Auto. If Freq Annotation is set to Center/Span, the X-axes on windows containing frequency domain traces are labeled with the center frequency on the left and the span on the right. If the Freq Annotation is set to Start/Stop, then the start and stop frequencies appear in place of center and span. If the X Scale is manual, then this annotation style does not apply.





Key Path	**SPAN/XScale**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:FANNotation CSPan|SSTop` `:DISPlay:<meas>:FANNotation?`
Example	DISP:VECT:FANN CSP DISP:VECT:FANN?
Preset	CSP
State Saved	Saved in instrument state.
Range	Center/Span | Start/Stop
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Copy X Scale

This front-panel only function copies the following X scaling information from the selected trace to another:

- X reference Position
- X Reference Value

- X Width
- X Scale (Auto/Man)

Key Path	**SPAN X Scale, X Axis Scaling**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Sweep/Control

This key displays a menu allowing you to control time-related measurement parameters, and to pause or resume the measurement.

Initial S/W Revision	A.01060 or later
Key Path	**Front Panel**
Mode	VSA

Main Time

This key allows you to control the length of the overall time record used in the measurement. Note that the Gate function (see below) allows you to analyze only a portion of the displayed Main Time. Time length and Res BW are related by the following equation:

Res BW = ENBW / T

where ENBW is the normalized effective noise bandwidth of the Window (see the FFT Window topic under BW for more details).and T is the time record length (in seconds).

Therefore, if you change Main Time, the Resolution bandwidth must also change, and vice versa.

Time record size (in sample points) can vary between 16 points and the full FFT size used for spectrum calculations. The FFT size is indirectly chosen by setting Freq Points (see below) and is equal to (Freq Points – 1)* 1.28.

Main Time length (in seconds) is the time record size times the sample period. The sample period for the Main Time result is 1/(1.28*Span).

Limits:

The maximum Main Time length is:

Max FFT size / (1.28 * Span) = (409600)/Spanif Freq points state parameter is set to Auto

FFT size / (1.28 * Span) = (Freq Points – 1)/Spanif Freq points parameter is manually set

Note that the minimum Res BW is related to maximum Main Time length.

The minimum Main Time length is

16 points / (1.28 * Span) = 12.5/Span

See Res BW and Res BW Coupling sections for details on couplings that can change Main Time length due to Res BW changes.

Remote Command	`[:SENSe]:<meas>:SWEep:TIME <time>` `[:SENSe]:<meas>:SWEep:TIME?`
Example	VECT:SWE:TIME 3 MS VECT:SWE:TIME?
Initial S/W Revision	A.01060 or later
Key Path	**Sweep Control**
Mode	VSA
Measurement	<meas>:=VECTor|ADEMod
Notes	This key is not available in measurements other than Vector or Analog Demod. The annotation is shown, however. In other measurements the time length is determined by number of symbols.
Couplings	Affected by Res BW, Span, Freq Points, and Window. See Res BW and Res BW coupling sections for details.
Preset	12.75e–6
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37

Pause / Resume

Pauses or resumes acquisition at the end of the current time record acquisition.

For more information see the Measurement Functions, Sweep/Control for a description of this function.

Initial S/W Revision	A.01060 or later
Key Path	**Sweep Control**
Mode	VSA

Gate

This key accesses a menu of time gating control functions. Time gating lets you isolate a portion of a Main Time record to be used for downstream spectrum and statistical analysis (instead of the whole time record). The gate position may be changed during a stopped measurement and the instantaneous gate time and spectrum traces update immediately. Averages are restarted when gate properties change. The windowing function used in gated measurements is the same as non-gated measurements.

For more information see the Measurement Functions, Sweep/Control, Gate for a description of this function.

Initial S/W Revision	A.01060 or later
Key Path	**Sweep Control**
Mode	VSA

Gate

This Boolean softkey turns time gating on or off

Remote Command	`[:SENSe]:<meas>:SWEep:EGATe:STATe OFF|ON|0|1` `[:SENSe]:<meas>:SWEep:EGATe:STATe?`
Example	VECT:SWE:EGAT:STAT ON VECT:SWE:EGAT:STAT?
Initial S/W Revision	A.01060 or later
Key Path	**Sweep/Control**
Mode	VSA
Measurement	<meas>:=VECTor|ADEMod
Preset	0
State Saved	Saved in instrument state.

Gate Length

This adjusts the time between the beginning and the end of the gate.

Remote Command	`[:SENSe]:<meas>:SWEep:EGATe[:SPAN] <time>` `[:SENSe]:<meas>:SWEep:EGATe[:SPAN]?`
Example	VECT:SWE:EGAT 2 MS VECT:SWE:EGAT?
Initial S/W Revision	A.01060 or later
Key Path	**Sweep/Control**
Mode	VSA
Measurement	<meas>:=VECTor|ADEMod
Couplings	Gate length and delay are limited so that the gate always falls within the current time record. If the time record length decreases, the gate delay is limited first, then the gate length.
Preset	1.28125e–6
State Saved	Saved in instrument state.

Min	16 time samples
Max	Time record length

Gate Delay

This adjusts the time between the start of the time record and the beginning of the gate .

Remote Command	`[:SENSe]:<meas>:SWEep:EGATe:DELay <time>` `[:SENSe]:<meas>:SWEep:EGATe:DELay?`
Example	VECT:SWE:EGAT:DEL 500 US VECT:SWE:EGAT:DEL?
Initial S/W Revision	A.01060 or later
Key Path	**Sweep/Control**
Mode	VSA
Measurement	<meas>:=VECTor|ADEMod
Couplings	Gate length and delay are limited so that the gate always falls within the current time record. If the time record length decreases, the gate delay is limited first, then the gate length.
Preset	0
State Saved	Saved in instrument state.
Min	0
Max	Time record length – gate length

Freq Points

By default, the analyzer chooses the number of Freq Points displayed in Spectrum or PSD displays, depending on the Res BW or Main Time length chosen. This softkey allows you to manually enter the number of displayed frequency points. Auto mode is recommended. The number of Freq Points is related to the number of FFT points used in spectrum calculations (which is always a power of 2).

Freq Points = (FFT points)/1.28 + 1

Note that if All Frequency Points is turned on for a selected trace, then all computed FFT points are shown. (See SPAN/X scale, All Frequency Points.)

Remote Command	`[:SENSe]:<meas>:SWEep:POINts <integer>`
	`[:SENSe]:<meas>:SWEep:POINts?`
	`[:SENSe]:<meas>:SWEep:POINts:AUTO OFF|ON|0|1`
	`[:SENSe]:<meas>:SWEep:POINts:AUTO?`

Example	VECT:SWE:POIN 801 VECT:SWE:POIN? VECT:SWE:POIN:AUTO ON VECT:SWE:POIN:AUTO?
Initial S/W Revision	A.01060 or later
Key Path	**Sweep Control**
Mode	VSA
Measurement	<meas>:=VECTor|ADEMod
Notes	Keyboard entry or setting this by SCPI forces state to manual. Any entry other than a valid value is rounded up to the next available value (or limited to the maximum). This key is not shown in measurements other than Vector or Analog Demod.
Couplings	See Res BW Coupling section See Res BW Coupling section
Preset	801 1
State Saved	Saved in instrument state.
Range	51|101|201|401|801|1601|3201|6401|12801|25601|51201|102401|204801|409601

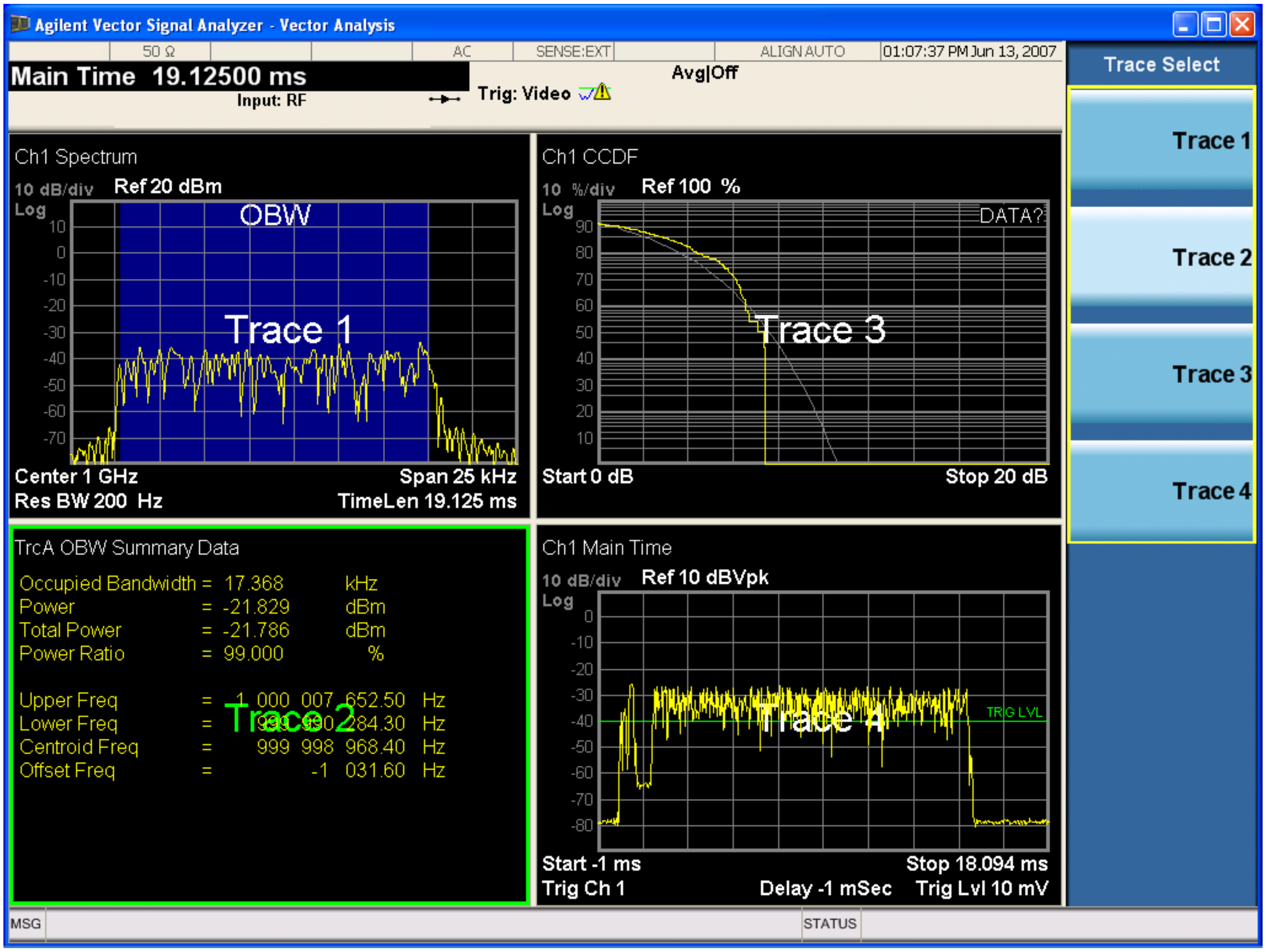
Trace/Detector

This key accesses a menu allowing you to select various trace parameters for all VSA based measurements.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Select Trace

This softkey brings up a menu that allows you to select the trace that is to receive the action of all successive trace-specific commands like scaling, assignment of trace data, etc. The selected trace is outlined in green and is always made visible. While the Select Trace menu is showing, Each visible trace is annotated in the middle with its own trace number, as shown: below. The trace number annotations disappear when any other menu is showing.



Grid 2x2 layout showing trace annotations when Trace Select dialog is active

This softkey also appears in the X and Y scaling menus. There is only one selected trace at any time. If you change which trace is selected, that change is reflected in this softkey/menu wherever it appears. Other ways to select a trace include use of the Next Window key, clicking within a trace window with a mouse cursor, and issuing a trace-specific SCPI command.

There is no SCPI command associated with this function. Instead, SCPI commands that are trace-specific have an index on the TRACe node that determines the selected trace. Using such a command has the side effect that the trace addressed by the SCPI command becomes the selected trace for any front panel interaction.

Key Path	**Trace/Detector (also Span / X Scale or AMPTD ? Y Scale)**
Mode	VSA, LTE, LTETDD, IDEN
Notes	No SCPI. Front panel only.
Couplings	Affects any trace-specific commands
Range	Trace 1|Trace 2|Trace 3|Trace 4|Trace 5|Trace 6
Readback Text	Trace <n>

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Data

This accesses a menu of Trace data choices for the selected trace. A VSA Measurement may produce many different results from a single scan; either a graph or a table. In addition, the ACP and OBW functions can be enabled on any trace showing a frequency-domain result, and produce Summary table results. Any of these results may be assigned to a trace and displayed. See the individual measurement PDs for a list of all Trace results that are available for each measurement.

The following Trace Data types are available in all measurements:

Soft Key Name	SCPI string form
No Data	"No Data"
Spectrum	"Spectrum1"
Inst Spectrum	"Inst Spectrum1"
Raw Main Time	"Raw Main Time1"
OBW Summary for Trace 1	"Obw Summary Trc1"
OBW Summary for Trace 2	"Obw Summary Trc2"
OBW Summary for Trace 3	"Obw Summary Trc3"
OBW Summary for Trace 4	"Obw Summary Trc4"
ACP Summary for Trace 1	"Acp Summary Trc1"
ACP Summary for Trace 2	" Acp Summary Trc2"
ACP Summary for Trace 3	" Acp Summary Trc3"
ACP Summary for Trace 4	" Acp Summary Trc4"

The following Data Registers are also available for display if there are traces stored in them (see Trace/Detector, Copy to Data Register and Recall, Data, Trace)

"D1", "D2", "D3", "D4", "D5", and "D6"

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:FEED <string>` `:DISPlay:<meas>:TRACe[1]|2|3|4:FEED?`

Example	DISP:VECT:TRAC1:FEED "Spectrum1" DISP:VECT:TRAC1:FEED?
Preset	Depends on trace number and measurement
State Saved	Saved in instrument state.
Range	see table above and in individual Measurement PDs
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

The complete list of Trace Data names that may be assigned using the above SCPI can be obtained by using the following SCPI query:

<table>
<tr><td>Mode</td><td>VSA, LTE, LTETDD, IDEN</td></tr>
<tr><td>Measurement</td><td><meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk</td></tr>
<tr><td>Remote Command</td><td>:CALCulate:<meas>:DATA[1]|2|3|4:NAMes?</td></tr>
<tr><td>Example</td><td>CALC:VECT:DATA:NAM?</td></tr>
<tr><td>Notes</td><td>Query only. Returns a comma-separated list of trace data names that may be used in DISPlay:<meas>:TRACe[1]|2|3|4:FEED "<string>". The list is the same regardless of trace index.</td></tr>
<tr><td>Initial S/W Revision</td><td>Prior to A.02.00</td></tr>
<tr><td>Modified at S/W Revision</td><td>A.02.00</td></tr>
</table>

Spectrum

This key assigns the selected trace to display the Spectrum data result.

The Spectrum trace data displays the spectrum of the selected channel. The spectrum computation displays frequency on the x axis and amplitude on the y axis.

The following formulas show how the analyzer calculates spectrum information:

Key: F = Fast Fourier Transform (FFT)
AF = Averaged spectra
AT = Averaged time
f = Instantaneous spectra
t = Instantaneous time
W = Windowing function
n = Average number
c = Correction trace (from calibration)
$f[n]^2 = f[n] \times \text{conjugate}(f[n])$
$\times$ = multiplication

No Average	$f = F(W \times t) \times c$
rms Average	$AF[n] = \frac{1}{n}\ \text{sum}\ (f\,[n]^2)$
rms Exponential AF[n]Average	$AF[n] = \frac{1}{n}\ (f\,[n]^2) + \frac{n-1}{n}\ AF[n-1]$ where $1 \leq n \leq$ number of averages
Continuous Peak Hold Average	$AF[n] = MAX\ (AF[n-1], f\,[n]^2)$
Time Average	$AF[n] = F\{W \times AT[n]\} \times c$ where $AT[n] = \frac{1}{n}\ \text{sum}\ (t\,[n])$
Time Exponential Average	$AF[n] = F\{W \times AT[n]\} \times c$ where $AT[n] = \frac{1}{n}\ t\,[n] + \frac{n-1}{n}\ AT[n-1]$ and $1 \leq n \leq$ number of averages

As shown in the previous formulas, the spectrum may be a linear spectrum or power spectrum as follows:

If the average is...	then the spectrum is...
Averaging OFF	Linear
rms Average	Power
Continuous peak	Power

Linear spectra contain magnitude and phase (real and imaginary) information. Remember however, that scalar measurements (produced by the Spectrum Analyzer application) do not provide phase information. Therefore, for scalar measurements, linear spectra have no phase information.

Power spectra contain only magnitude (real) information. This occurs with rms averages, for instance, because the results of the FFT are squared. Remember that the FFT yields both real and imaginary information. When the analyzer squares the results of the FFT, the imaginary part becomes zero.

See also Trace/Detector, "Data" on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

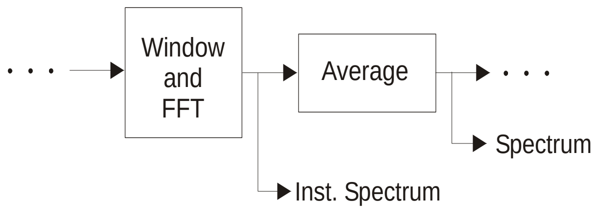
Inst Spectrum

This key assigns the selected trace to display the Inst. Spectrum data result.

Inst Spectrum trace data displays the instantaneous spectrum for the selected input channel. Instantaneous spectrum is computed before data is averaged, which allows you see spectrum data before the data is averaged with other spectrum data.

NOTE Inst Spectrum is not available when analog or digital demodulation is selected.

The following block diagram shows where, in the block diagram, spectrum and instantaneous spectrum are created.



This measurement calculation is useful for these types of averaged measurements:

- rms
- rms exponential
- Continuous peak hold

If averaging is off, the spectrum and instantaneous spectrum display the same information.

See also Trace/Detector, "Data" on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Main Time

This key assigns the selected trace to display the Main Time data result.

Note that Main Time is not available when analog or digital demodulation is selected.

Main Time versus Gate Time

The term is used to differentiate between the "main" time record and the "gate" time record when time gating is on.

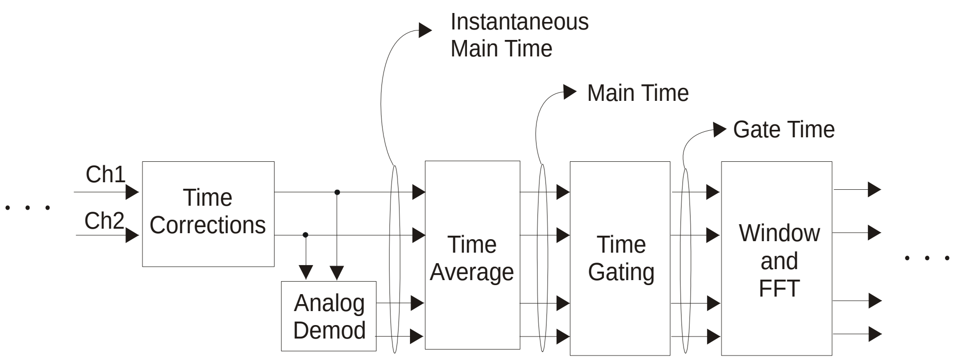
A time record is the basic building block of the Fast Fourier Transform (FFT). The FFT takes the time-domain information in the time record and transforms it into the frequency domain.

When time gating is on, you can identify a portion of the main time-record to be used by the FFT. The term "main time-record" identifies the entire time record; the term "gate time-record" identifies the portion selected by the gate.

Selecting the Main Time trace data displays the entire time record--the main time-record. Selecting the Gate Time trace data displays that portion of the main time-record marked by the gate--the gate time-record.

The following block diagram shows the blocks that create main time and gate time.

Note that the Analog Demodulation block is available only when analog demodulation is enabled



There are many reasons why you may want to view the main time record. Here are just a few:

To verify that there is an input signal.

To see the characteristics of the input signal.

To help in manually setting the input range.

Time Records and Span

If you set the analyzer to full span, the time data you see is the actual input time-record. This is raw input data--the signal from which all subsequent measurements are based.

If you set the instrument to measure a specific bandwidth (something less than full span), the time data you see is the raw input data after it has been filtered (to provide alias protection) and decimated (to obtain the desired span).

Time Records and Averaging

If rms or continuous peak-hold averaging is on, the analyzer displays the most recent time record. The analyzer does not show an averaged time waveform, because all averaging is done after the time data has been transformed to the frequency domain.

If time averaging is on, the analyzer displays the averaged time-record. In other words, the time record has been averaged with previous time records.

How the Analyzer Displays the Time Record

It is important to remember that although the time record looks like an oscilloscope display, the analyzer is not a digital oscilloscope.

The time record represents samples of a waveform. The samples have enough information to accurately reconstruct the input signal--but the human eye may not properly perform the reconstruction. In fact, for frequencies that are higher than about ten percent of the frequency span, there will be noticeable visible distortion.

The analyzer's anti-alias filters will cause some ringing or distortion of square waves or transients when viewed in the time domain.

See also Trace/Detector, “Data” on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

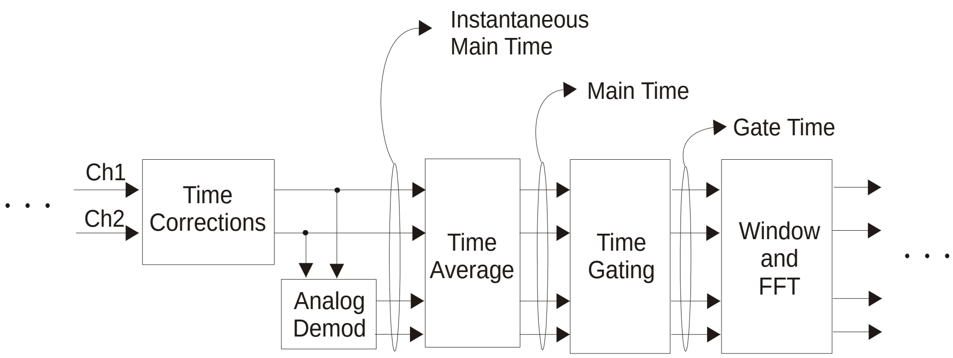
Inst Main Time

This key assigns the selected trace to display the Inst Main Time data result.

Inst Main Time trace data displays the instantaneous time-domain data for the selected input channel.

Note that Inst Main Time is not available when analog or digital demodulation is selected.

The following block diagram shows how Instantaneous Main Time is derived.



Notice that Instantaneous Main Time shows you time data before time averaging. If time averaging is off, Instantaneous Main Time is identical to Main Time.

See also Trace/Detector, “Data” on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Gate Time

This key assigns the selected trace to display the Gate Time data result.

Gate Time trace data displays the selected channel's gate time-record.

Note that Gate Time is not available when analog or digital demodulation is selected.

If time gating is on, Gate Time displays the portion of the main time-record marked by the gate-- this portion is called the gate record (if time gating is off, Gate Time displays nothing).

As a reminder, if time gating is on, the Fast Fourier Transform (FFT) uses the gate time-record, which can be all or a portion of the main time-record, to compute frequency information such as spectrum, frequency response, coherence, and correlation.

See also Trace/Detector, “Data” on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Raw Main Time

This key assigns the selected trace to display the Raw Main Time data result.

Raw Main Time is the raw data read from the input hardware or playback file. It is similar to “Raw Main Time” on page 436 with the following exceptions:

- This data has not had time corrections applied, so it displays a "CAL?" trace indicator.
- The data has not gone through the analyzer's software resampling filters, so is generally not sampled at the specified sample rate.
- The data has a wider bandwidth than the measurement span would indicate.

Raw Main Time data is useful in the following situations:

- When you use Channel, IF Magnitude, or Magnitude trigger types, the input hardware detects the trigger, so Raw Main Time sometimes gives a better indication of what caused the trigger.
- When you play back a recording, the Raw Main Time measurement data allows you to see exactly the samples that are saved in the recording, with no filtering applied or settling removed.

See also Trace/Detector, “Data” on page 430.

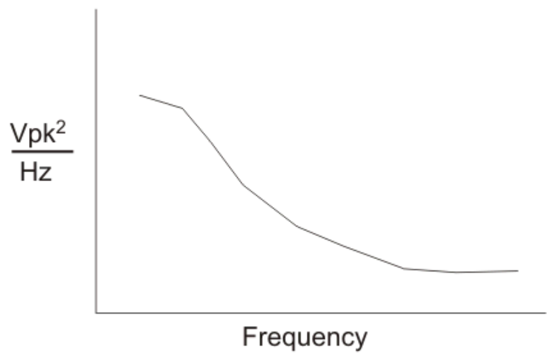
Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

PSD (Power Spectral Density)

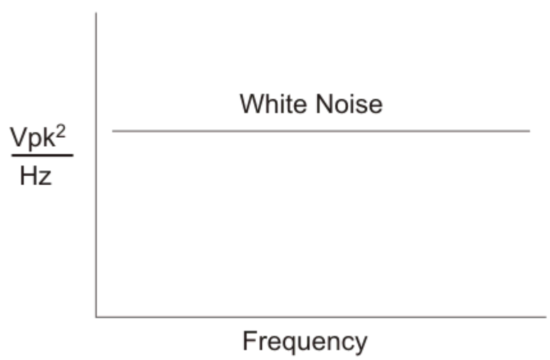
This key assigns the selected trace to display the Power Spectral Density (PSD) data result.

PSD trace data displays the power spectral density (PSD) of the selected channel.

The definition of PSD yields y-axis units of Vpk2/Hz and x-axis units of frequency:



PSD is used for noise measurements. It shows the power density of a signal as a function of frequency. In general, noise may have any arbitrary frequency content, resulting in a variety of possible PSD shapes. Noise that has equal power density at all frequencies is called white noise:



The definition of PSD is power per Hertz. In other words, power is divided by the measurement bandwidth, which in this analyzer is the resolution bandwidth (ResBW), as follows:

$$\frac{Vpk^2}{RBW} = \frac{Vpk^2}{Hz}$$

Units of Vpk2/Hz assumes the signal is referenced to 1 ohm. That is, because no resistance is specified, the signal is interpreted as a voltage across a one ohm resistor, with the power in the resistor equal to Vpk2.

You can select units of dBm/Hz to take into account the analyzer's input impedance. PSD defaults to these units. The analyzer calculates dBm/Hz as follows:

$$\frac{\text{dBm}}{\text{Hz}} = 10 \log \left[\frac{\frac{\text{Vrms}^2}{Z} \times 1000}{\text{RBW}} \right]$$

where:

RBW = resolution bandwidth (Hz)

Z = input impedance

See also Trace/Detector, “Data” on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Auto Correlation

This key assigns the selected trace to display the Power Spectral Density (PSD) data result.

Auto Correlation trace data displays the autocorrelation for the selected input channel. Autocorrelation is a form of correlation, a measure of the similarity between two signals.

Note that Auto Correlation is not available when digital demodulation is selected.

Tips

Use ac coupling only. Correlation measurements are disturbed by dc offsets in the signal.

Some types of averaging may be useful -- rms averaging does not affect correlation measurements, but you can use time averaging to reduce noise, if you can provide a consistent trigger. However, averaging is usually unnecessary to make good correlation measurements.

Use appropriate triggering and trigger delays. This is especially true for time averaging.

Use a random noise source for delay measurements. Correlation measurements provide the ability to resolve time differences between waveforms that appear to be random.

Waveforms on the correlation trace may not appear as they do in the time trace. This is particularly noticeable when you are using correlation to extract synchronous signals from noise. The different shape of some waveforms is a direct result of the mathematical definition of correlation. For example, a correlated square wave appears as a triangle wave. It's important to remember that the period of the waveform is preserved even if the correlation waveform looks different.

To avoid wrap-around effects, correlation produces a time record one-half the length of the measurement time-record.

Theory of Operation

Autocorrelation is a form of correlation, a measure of the similarity between two signals. Correlation is performed by multiplying two signals together at each instant in time and summing all the products. If the signals are identical, every product is positive and the resulting sum is large.

If, however, the two signals are dissimilar, then some of the products are positive and some are negative. In this case, the final sum is smaller because the products tend to cancel.

Autocorrelation performs a time-shifted, "averaged" correlation on a single signal. The signal is correlated with time-shifted versions of itself. Furthermore, the products from each time-shift are averaged by dividing each final sum by the number of products contributing to it.

$$Rxx(\tau) = \lim_{T\to\infty} \frac{1}{T} \text{ intgrl } [\text{conj } [x(t)] \times x(t+\tau)] \text{ dt}$$

where: Rxx = autocorrelation function
τ = amount of time shift
= infinity
$x(\tau)$ = signal to be correlated
intgrl = integration
conj = conjugation
T = time
$\times$ = multiplication

That is, the autocorrelation function is found by taking a signal, multiplying it by the same signal displaced (tau) units in time, and averaging the product over all time.

Duality With the Power Spectrum

For simplicity and speed, this analyzer performs the autocorrelation operation by taking advantage of its duality with the power spectrum:

$$Rxx(\tau) \leftrightarrow Gxx(f)$$

Thus,

$$Rxx(\tau) = I_{FFT}[Gxx(f)]$$
$$= I_{FFT}[\text{conj}(F[r \times t]) \times F(t)]$$

where: I_{FFT} = Inverse FFT
conj = conjugation
$\times$ = multiplication
r = half size of the rectangular window
(thus the result is ½ the original time length)

When to use Auto Correlation

Auto correlation is useful for detecting echoes in a signal. For random noise, an echo appears as an impulse -- if there is more than one echo, you will see multiple peaks on the auto correlation trace. Keep in mind that an echo appears as an impulse only if the delayed signal has not been filtered. The impulse broadens as the original random noise signal is filtered -- in fact, the width of each peak is inversely proportional to the bandwidth of the signal.

To determine the time delay (in seconds) of an echo, you can move the marker to the peak of the echo. Note that there is always a correlated peak at zero lag -- this peak marks the original excitation signal. Any other peaks let you know that the excitation signal also appeared at another time relative to the original signal. The amplitude value at the zero lag point is the total power in the time record.

This function is also useful for isolating low-level periodic signals from noise. A sine wave signal shows up as a sine wave in auto correlation. A square wave signal shows up as a triangular wave of the same frequency.

Auto correlation is a single-channel measurement. If you have the original signal on one channel and the delayed version on another, use cross correlation.

Auto Correlation and Averaging

The following formulas show how the analyzer calculates auto correlation for different averaging functions:

Key: F = Fast Fourier Transform (FFT)
AC = Averaged correlation
AT = Averaged time
t = Instantaneous time
c = Instantaneous correlation
r = 1/2 width rectangular window
$\times$ = multiplication
n = Average number

No Average $c = I(\text{conj}(F(r \times t)) \times F[t])$

rms Average $c = I(\text{conj}(F(r \times t)) \times F[t])$

rms Expon. Average $c = I(\text{conj}(F(r \times t)) \times F[t])$

Continuous Peak Hold Average $c = I(\text{conj}(F(r \times t)) \times F[t])$

Time Average $AC[n] = I(\text{conj}(F(r \times AT[n])) \times F(AT[n]))$

$$\text{where: } AT[n] = \frac{1}{n}\,\text{sum}(t[n])$$

Time Expon. Average $AC[n] = I(\text{conj}(F(r \times AT[n])) \times F(AT[n]))$

$$\text{where: } AT[n] = \frac{1}{n}\,t[n] + \frac{n-1}{n}\,AT[n-1]$$

and: $1 < n <$ number of averages

See also Trace/Detector, “Data” on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA
Initial S/W Revision	Prior to A.02.00

Statistical

This key accesses the Trace Data choices which show statistical results.

Key Path	**Trace/Detector, Data**
Mode	VSA

CCDF (Complementary, Cumulative Density Function)

This key assigns the selected trace to display the CCDF data result.

CCDF trace data displays the complementary, cumulative density function (CCDF) for the selected input channel.

The complementary, cumulative density function (CCDF) is a statistical-power calculation and can be performed only on time-domain data. As its name suggests, CCDF is the complement of CDF, and is defined as follows:

$$CDF(K) = Probability(x \leq K)$$
$$CCDF(K) = Probability(x \geq K)$$

CCDF provides better resolution than CDF for low probability signals, especially when log format is used for the y-axis.

The analyzer plots CCDF using units of percent (%) for the y-axis and power (dB) for the x-axis. Power on the x-axis is relative to the signal average power, so 0 dB is the average power of the signal. Therefore, a marker readout of

```
Trace A Marker 2 dB 12 %
```

means there is a 12% probability that the signal power will be 2 dB or more above the average power.

CCDF Calculation:

Calculate the RMS value for all measured samples; this becomes the 0 dB point at the left end of the x-axis.

Normalize all samples to the RMS value in units of dB.

Determine which x-axis bin each sample belongs in between 0 and 20 dB.

Calculate the total number of samples that are greater than or equal to each x-axis bin and plot as a percent of the number of samples measured.

Samples Used in the Power Measurement

For the Demod Off and Analog demod modes, the analyzer computes CCDF using all samples in the current time record (all points in the active trace). Each successive time record adds additional samples to the CCDF measurement.

For WLAN - OFDM and -DSSS demod modes, the analyzer computes CCDF using all samples specified within the measurement interval.

Restarting the Power Measurement

Selecting CCDF, restarting the measurement, or changing most measurement parameters restarts the CCDF measurement. For example, changing the range or center frequency resets the number of samples used in the CCDF measurement to zero and restarts the CCDF measurement.

Tips

Note the following when making CCDF measurements:

For best results, set the analyzer's displayed frequency span to include all the energy of your signal. In other words, make sure the displayed frequency span includes the entire bandwidth of the measured signal.

The CCDF measurement does not restart:

After a calibration

After you continue a paused measurement

Many channel specific changes restart the CCDF measurement on both channels, such as changing the gate delay, or input coupling.

The analyzer displays DATA? if the average power drifts 8 to 10 dB from the average power measured in the first time record. For example, the analyzer would display DATA? if you measured a transmitter signal that was off when the CCDF measurement started but then turned on later in the measurement.

CCDF measurements are disabled during time averaging.

See also Trace/Detector, "Data" on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

CDF (Cumulative Density Function)

This key assigns the selected trace to display the CDF data result.

CDF trace data displays the Cumulative Density Function (CDF) for the selected input channel. CDF is computed by integrating the PDF (Probability Density Function). CDF is explained in online help for the CCDF trace data for further details, see that topic

See also Trace/Detector, "Data" on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

PDF (Probability Density Function)

This key assigns the selected trace to display the PDF data result.

PDF trace data displays the Probability Density Function of the selected channel. PDF indicates the probability that a given level has occurred.

PDF is equivalent to a normalized histogram. A histogram shows how the amplitude of a signal is distributed between its maximum and minimum values. Amplitude is displayed on the X-axis, and number of counts on the Y-axis.

The number of averages for a histogram determines the number of counts in the histogram; in other words, how many records are measured¾the records are not "averaged". If averaging is off or if exponential averaging is selected, the measurement continues indefinitely. Keep in mind that the accuracy of the histogram is dependent on the frequency span, time-record length, and number of averages (if averaging is on).

Histograms are used for such things as determining the statistical properties of noise and monitoring the performance of electromechanical positioning systems.

PDF trace data is normalized by multiplying the number of averages by the number of points in the time record, then dividing this value by the DV spacing on the X-axis. The probability of a signal falling between two points is equal to the integral of the curve between those points.

PDF trace data displays the number of points used in its computation above the trace (Pts:). It also displays the average level (Avg:) above the trace.

See also Trace/Detector, "Data" on page 430.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Format

This accesses a menu that allows you to choose the format of the selected trace. Any format may be assigned to any trace. For symbol tables and tabular data the format choice is ignored. If the data doesn't have defined symbol times, Constellation format is the same as I-Q, Eye formats are the same as Real or Imaginary, and Trellis format is the same as Unwrapped Phase.

The formats are:

Format name	Description
Log Mag (dB)	Data is converted to decibel units and shown on a linear Y axis
Linear Mag (Abs Value)	Magnitude of the data is shown on a linear Y axis
Real (I)	Real part of data is shown on a linear Y axis
Imaginary (Q)	Imaginary part of data is shown on linear Y axis
I-Q	Real part of data is shown on horizontal axis, imaginary part is shown on vertical axis, Independent variable (X axis) is normal to display
Constellation	Same as I-Q, but for data with symbols defined, only the symbol points are shown as dots with no connecting lines.
Wrap Phase	Phase of complex data, limited to ± 180 deg, is shown on Y axis
Unwrap Phase	Phase of complex data is shown "unwrapped", that is, without discontinuities. Not limited to ± 180 degrees.

Format name	Description
I-Eye	Real part of data is shown with X axis segmented (generally into 2 symbol segments) and each segment is overlaid to show signal crossings at symbol boundaries
Q-Eye	Same as I-eye but imaginary part of data is shown
Trellis	Same as I-eye but uses unwrapped phase of data
Group Delay	Useful for frequency response displays. Shows the derivative of phase response with respect to frequency.
Log Mag (Linear Unit)	Displays data with a logarithmic Y axis, but marker read outs are in linear magnitude units.

Key Path	**Trace/Detector, Format**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat MLOG|MLINear|REAL|IMAGinary|VECTor|CONS|PHASe|UPHase|IEYE|QEYE|TRELlis|GDELay|MLGLinear` `:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat?`
Example	DISP:DDEM:TRAC2:FORM MLIN DISP:DDEM:TRAC2:FORM?
Preset	Depends on trace and measurement
State Saved	Saved in instrument state.
Range	Log Mag (dB)|Linear Mag (Abs Value)|Real (I) (Lin)|Imaginary (Q) (Lin)|I-Q|Constellation|Wrap Phase|Unwrap Phase|I-Eye|Q-Eye|Trellis-Eye|Group Delay|Log Mag (Linear Unit)
Readback Text	Log Mag (dB)|Linear Mag|Real (I)|Imaginary (Q)|I-Q|Constellation|Wrap Phase|Unwrap Phase|I-Eye|Q-Eye|Trellis-Eye|Group Delay|Log Mag
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Digital Demod Trace Setup

This key accesses a menu of settings that control certain elements of displays of digitally demodulated trace data.

Key Path	**Trace/Detector**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00

Symbol Shape

For all time-domain displays except IQ diagrams, Symbol Shape lets you display dots, bars, or nothing (none) at symbol locations (if the trace contains demodulated time-domain data). This key allows you to select the symbol shape for the selected trace.

If you select bars, vertical lines (bars) are drawn from the baseline to the symbol location on the trace. The baseline is 0 for all traces that have coordinates other than log (dB). The baseline is the bottom of the trace box for traces that have log (dB) coordinates.

With IQ diagrams, displaying vertical bars is meaningless. Therefore, selecting bars displays dots in IQ diagrams.

With constellation diagrams, selecting none is the same as selecting bars--you cannot turn off the dots in a constellation diagram.

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol BARS|DOTS|OFF` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol?`
Example	DISP:DDEM:TRAC2:DDEM:SYMB DOTS DISP:DDEM:TRAC2:DDEM:SYMB?
Preset	BARS
State Saved	Saved in instrument state.
Range	Bars|Dots|None
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Ideal State Shape

Digital Demodulation shows you the location of all ideal symbol states in an I-Q or constellation diagram. This key lets you choose between a cross, circle, or none to represent the ideal state on the selected trace.

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol:SHAPe CIRCle|CROSs|OFF` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol:SHAPe?`
Example	DISP:DDEM:TRAC2:DDEM:SYMB:SHAP CIRC DISP:DDEM:TRAC2:DDEM:SYMB:SHAP?
Preset	CIRC
State Saved	Saved in instrument state.
Range	Circle|Cross|None
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Ideal State Size

Determines the ideal state size, as a percentage of the maximum ideal state distance from the origin (the same way Error Vector Magnitude is defined). Ideal states are shown as circles or crosses in Vector and constellation diagrams, as determined by the Ideal State Shape setting.

The ideal state is where symbols occur if your signal is without error. Showing the ideal states gives a visual indication of the quality of your signal.

You can use this feature to determine if symbols have an EVM above a specified Value. For example, to see if any symbols have an EVM greater than 10%, set the state size to 10% and select Circle as the shape. Any symbols that fall outside of the circle (other than SYNC or PILOT symbols) have an EVM greater than 10%.

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol:SIZE <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol:SIZE?`
Example	DISP:DDEM:TRAC2:DDEM:SYMB:SIZE 10 DISP:DDEM:TRAC2:DDEM:SYMB:SIZE?
Notes	Parameter is interpreted as a percent, e.g., if you want the ideal size to be 10% send 10, not 0.1
Preset	5
State Saved	Saved in instrument state.
Min	0.1
Max	50

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Symbol Table Format

This allows you to choose the format in which symbol table data is displayed, when the modulation format encodes 4 or more bits per symbol. You may choose binary or hexadecimal. Binary symbol data is padded with leading zeros to make a multiple of 4 bits before conversion to hexadecimal. For example, for 16 QAM format, each 4-bit symbol will be displayed as 2 hex digits.

Binary Format: The symbol data bit format is binary and each character represents a binary digit. The number to the left of each row indicates the bit offset of the first bit in the row.

Hexadecimal Format: The symbol data bit format is hexadecimal and each character represents a hexadecimal digit. The number to the left of each row indicate the symbol offset of the first symbol in the row.

NOTE	There must be at least 4 bits/symbol to use the hexadecimal format, that is, symbols that have less than 4 bits/symbol will only be displayed in binary format regardless of the Symbol Table Format setting.

This parameter is valid only when:

- The active trace is a symbol table, and
- The current demodulation format supports hexadecimal, the demodulation format's bits/symbol is equal to or greater than four.

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol:FORMat HEXadecimal|BINary` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:SYMBol:FORMat?`
Example	DISP:DDEM:TRAC2:DDEM:SYMB:FORM BIN DISP:DDEM:TRAC2:DDEM:SYMB:FORM?
Preset	HEX
Range	Hex | Binary
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Eye Length

This property controls how wide (in symbol periods) the eye and trellis diagrams are, for the selected trace.

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:EYE:COUNt <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:EYE:COUNt?`
Example	DISP:DDEM:TRAC2:DDEM:EYE:COUN 3 DISP:DDEM:TRAC2:DDEM:EYE:COUN?
Preset	2
State Saved	Saved in instrument state.
Min	0.1
Max	40
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Time Unit

This property lets you select the time units that are applied to x-axis annotations and marker readouts for the selected trace, whenever it is assigned data with (demodulation) symbol information. The available measurement units are sym (symbols) or sec (seconds).

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:UNIT:TIME SEC|SYMBol` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:UNIT:TIME?`
Example	DISP:VECT:TRAC2:DDEM:UNIT:TIME SYMB DISP:VECT:TRAC2:DDEM:UNIT:TIME?
Preset	SYMB
State Saved	Saved in instrument state.
Range	sym|sec
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Freq Unit

This property lets you select the frequency units that are applied to x-axis annotations and marker readouts for the selected trace, whenever it is assigned data with (demodulation) carrier information. The available measurement units are carrier or Hz.

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:UNIT:FREQuency CARRier|HZ` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:UNIT:FREQuency?`
Example	DISP:VECT:TRAC2:DDEM:UNIT:FREQ CARR DISP:VECT:TRAC2:DDEM:UNIT:FREQ?
Preset	CARR
State Saved	Saved in instrument state.
Range	carrier|Hz
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Avg Line

This controls whether or not the average line is visible on certain demodulation analysis traces such as Error Vector Time and Error Vector Spectrum in OFDM related modulation analysis measurements. These traces have 2-dimensional domains; typically subcarriers (frequency) and symbol times. Since the result can only be shown with one of these dimensions on the x-axis, the other dimension is placed on the z-axis. Since all the z-axis values are overlapped, an average is calculated for all z values at each x value and the average is normally displayed as a line in front of trace. The average line display can be turned on or off using this control.

Key Path	**Trace/Detector, Digital Demod Trace Setup**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:ALINe OFF|ON|0|1` `:DISPlay:<meas>:TRACe[1]|2|3|4:DDEMod:ALIN?`
Example	DISP:W11A:TRAC:DDEM:ALIN OFF
Preset	1
State Saved	Saved in instrument state.

Initial S/W Revision	A.03.00 or later

Copy to Data Register

This key accesses a menu of immediate execute keys, each of which copies the selected trace to a particular data register. Data registers can be displayed in any trace. They are measurement global, so you can copy data to a register while in the Digital Demod measurement and view it later while in the Vector measurement. Data registers are cleared when the VSA Application is exited and reentered, but not when you change Modes and return.

Key Path	**Trace/Detector**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:COPY D1|D2|D3|D4|D5|D6`
Example	DISP:VECT:TRAC:COPY D1
Readback Text	Last: <date_time>|Empty
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

The following SCPI provides means to determine if a Data Register is empty, and to erase the data from any or all Data Registers.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:CALCulate:DATA:REGister[1]|2|3|4|5|6:EMPTy?`
Example	:CALC:DATA:REG2:EMPT?
Notes	Query only: returns 1 if a Data Register has no trace data assigned to it.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:CALCulate:DATA:REGister[1]|2|3|4|5|6:REMove`
Example	:CALC:DATA:REG2:REM
Notes	Removes trace data assigned to specified Data Register.
Couplings	If Data Register is assigned to a trace, the trace data is changed to No Data

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	:CALCulate:DATA:REGister:ALL:REMove
Example	:CALC:DATA:REG:ALL:REM
Notes	Removes trace data assigned to all Data Registers.
Couplings	If Data Register is assigned to a trace, the trace data is changed to No Data
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Phase/Delay Properties

This key accesses a menu of properties that affect the selected trace when displayed using phase or delay formats

Key Path	**Trace/Detector**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Phase/Trellis Offset

This is only used if the trace Format is Wrap Phase, Unwrap Phase or Trellis. For Unwrap Phase or Trellis displays, the phase offset value is added to the existing phase at each point. For example, If you are viewing an Unwrapped Phase trace, setting the Phase/Trellis Offset to 5 degrees moves the entire trace up 5 degrees (and changes the value displayed by a marker by the same amount). For Wrap Phase displays the phase offset only affects the phase wrap point, not the underlying data. The point at which the phase wraps is 180 degrees plus the phase offset. For example, suppose you have a marker on a Wrap Phase display whose phase offset is 0 and the marker is showing –3 degrees. The trace data will all be confined within (–180, 180] degrees. If you then change the phase offset to 180 degrees, then the Wrap Phase display will show values within the interval (0, 360] degrees and the marker value will be displayed as 357 degrees, which is the wrapped equivalent of –3 degrees.

Key Path	**Trace/Detector, Phase Delay Properties**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat:PHASe:OFFSet <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat:PHASe:OFFSet?`
Example	DISP:DDEM:TRAC3:FORM:PHAS:OFFS 31 DISP:DDEM:TRAC3:FORM:PHAS:OFFS?
Preset	0
State Saved	Saved in instrument state.
Min	–1E+8
Max	1E+8
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Unwrap Phase Ref

Unwrapped phase lets you designate the point (x-axis) value about which phase values are to be unwrapped. That is, the phase at the designated reference will be within –180 to 180 degrees, and phase will vary smoothly without jumps around that point.

Key Path	**Trace/Detector, Phase Delay Properties**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat:PHASe:UNWRap:REFerence <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat:PHASe:UNWRap:REFerence?`
Example	DISP:DDEM:TRAC3:FORM:PHAS:UNWR:REF 24.5E6 DISP:DDEM:TRAC3:FORM:PHAS:UNWR:REF?
Preset	0
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Group Delay Aperture

The value of Delay Aperture is used when the trace format is Group Delay. The aperture is specified as a percentage of the current frequency span for frequency-domain data. It is specified as a percentage of the time-record length for time-domain data.

When group delay is calculated for a given point (which can be a time- or frequency-domain point), the aperture is centered at that point. Larger apertures decrease resolution, but they increase the smoothing of the group-delay trace.

The point plotted for group delay is located between the data points used to calculate it. For example, in the frequency domain, the group delay for 100 Hz may be calculated by measuring the change in phase between 90 and 110 Hz. If you had specified a start frequency of 90 Hz, 100 Hz would be the first point with group delay data. This results in a trace that does not extend to the edges of the screen (more noticeable as the delay aperture increases).

Note that the smallest aperture that you can select depends on the number of frequency points. If you select an invalid aperture, the analyzer automatically selects the smallest valid aperture.

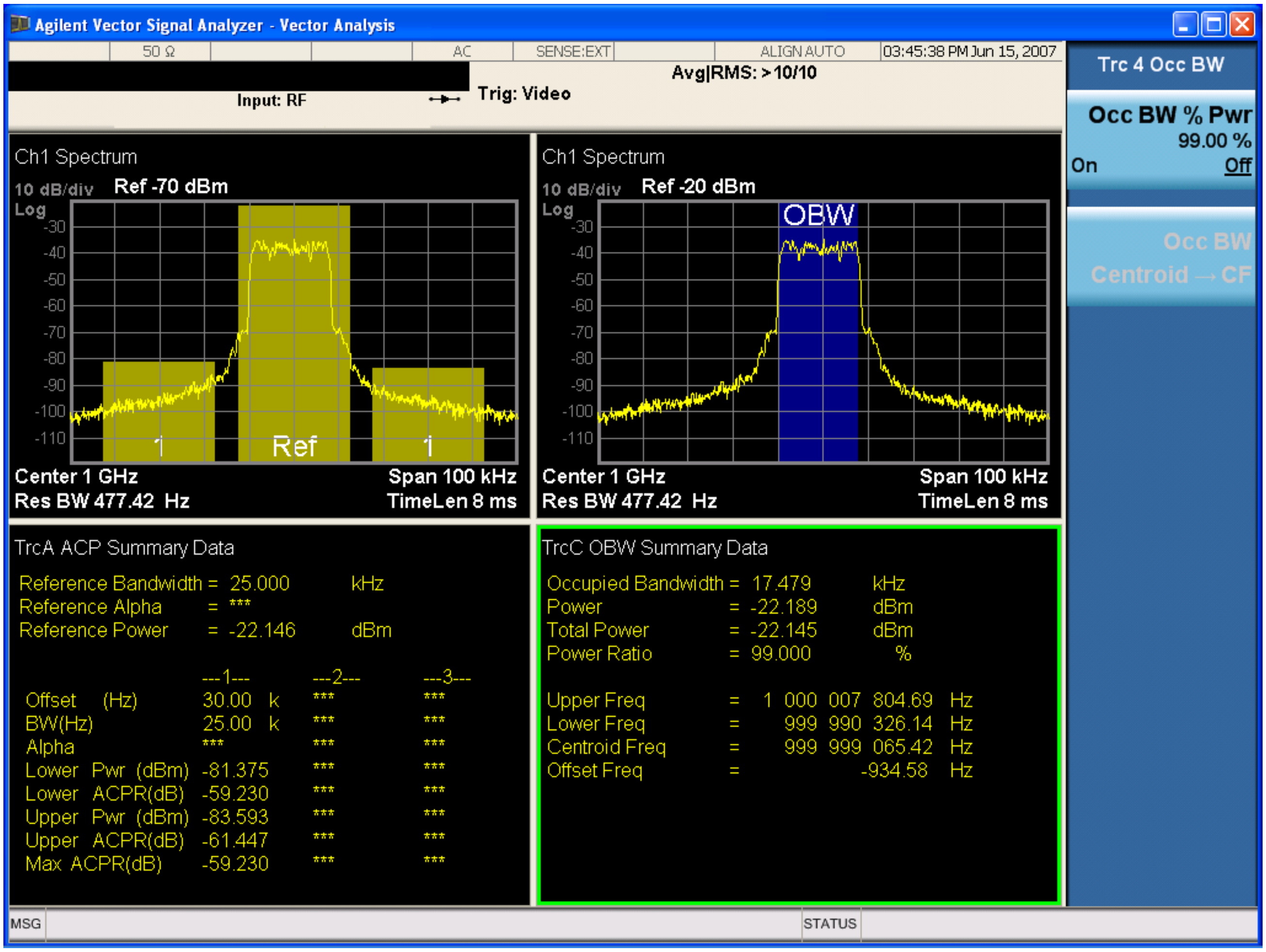
Key Path	**Trace/Detector, Phase Delay Properties**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat:DELay:APERture <real>` `:DISPlay:<meas>:TRACe[1]|2|3|4:FORMat:DELay:APERture?`
Example	DISP:DDEM:TRAC3:FORM:DEL:APER 1 DISP:DDEM:TRAC3:FORM:DEL:APER?
Notes	Parameter is interpreted as a percent, e.g., if you want the group delay aperture to be 1% send 1, not 0.01
Preset	0.5
State Saved	Saved in instrument state.
Min	0.00390625
Max	16
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

ACP Setup

The adjacent channel power (ACP) function calculates the power in a reference band of frequencies as well as bands of frequencies offset from the reference, and calculates the ratio of each offset band to the reference band power.

The ACP key accesses a menu of functions that allow you to define and turn on the ACP function on the selected trace. One reference channel and up to 5 offset frequencies may be defined, and ACP will be calculated for bands both above and below the reference frequency for each offset.

An ACP measurement may be defined for each trace, although it will only be active on frequency-domain trace data. The reference and offset frequency bands defined by the ACP measurement are shown as gold bars overlaying the trace display. To see tabular data showing power and power ratio results, you may assign the ACP Summary (Trace n) to a different trace. For example, you can assign Spectrum data to trace 1, turn on and define an ACP measurement on trace 1, assign the ACP Summary (Trace 1) to trace 2, and use a 2x2 display to view both at the same time, as shown below



The summary data may be retrieved programmatically using FETCh? or the CALCulate:<meas>:DATA:TABLe commands. See the Data Queries section under Common Functions for more details.

Key Path	**Trace/Detector**
Mode	VSA, LTE, LTETDD, IDEN
Readback Text	[On|Off,]
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

ACP Summary for Trace 1

Select trace for assignment of ACP Data.

See also “ACP Setup” on page 453

Key Path	**Trace/Detector, Data, ACP, Channel n**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

ACP Summary for Trace 2

Select trace for assignment of ACP Data.

See also “ACP Setup” on page 453

Key Path	**Trace/Detector, Data, ACP, Channel n**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

ACP Summary for Trace 3

Select trace for assignment of ACP Data.

See also “ACP Setup” on page 453

Key Path	**Trace/Detector, Data, ACP, Channel n**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

ACP Summary for Trace 4

Select trace for assignment of ACP Data.

See also “ACP Setup” on page 453

Key Path	**Trace/Detector, Data, ACP, Channel n**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

ACP Summary for Trace 5

Select trace for assignment of ACP Data

See also "ACP Setup" on page 453.

Key Path	**Trace/Detector, Data, ACP, Channel n**
Mode	VSA

ACP Summary for Trace 6

Select trace for assignment of ACP Data.

See also "ACP Setup" on page 453

Key Path	**Trace/Detector, Data, ACP, Channel n**
Mode	VSA

ACP On/Off

This softkey turns the ACP function on or off for the selected trace

Key Path	**Trace/Detector, ACP**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:STATe OFF|ON|0|1` `:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:STATe?`
Example	CALC:VECT:TRAC1:ACP:STATE ON CALC:VECT:TRAC1:ACP:STATE?
Preset	0
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Carrier Freq

This key allows you to enter the carrier frequency of the reference channel for the ACP measurement. The carrier frequency is relative to the center frequency of the measurement. There is only one available reference carrier.

Key Path	**Trace/Detector, ACP**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:FREQuency <freq>` `:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:FREQuency?`
Example	CALC:VECT:TRAC1:ACP:CARR:FREQ 100 KHZ CALC:VECT:TRAC1:ACP:CARR:FREQ?
Preset	0
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Carrier Meas Noise BW

This key allows you to define the measurement noise bandwidth of the reference channel.

Key Path	**Trace/Detector, ACP**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:BANDwidth|BWIDth:INTegration <bandwidth>` `:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:BANDwidth|BWIDth:INTegration?`
Example	CALC:VECT:TRAC1:ACP:CARR:BAND:INT 1 MHZ CALC:VECT:TRAC1:ACP:CARR:BAND:INT?
Preset	1000000
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Carrier RRC Weighting

This key turns on or off RRC weighting for the reference (carrier) power measurement.

Key Path	**Trace/Detector, ACP**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:FILTer:RRC:STATe OFF|ON|0|1` `:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:FILTer:RRC:STATe?`
Example	CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:STAT ON CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:STAT?
Preset	0
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Carrier Filter Alpha

This key allows you to adjust the alpha of the RRC filter for the reference (carrier) power measurement.

Key Path	**Trace/Detector, ACP**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:FILTer:RRC:ALPHa <real>` `:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:CARRier:FILTer:RRC:ALPHa?`
Example	CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:ALPH 0.22 CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:ALPH?
Preset	0.35
State Saved	Saved in instrument state.
Min	0
Max	1
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00

Offsets

The ACP measurement compares power in frequency bands offset from the carrier to power in the reference channel (centered on the carrier). Up to 5 offsets may be defined. The offsets are designated by letters A through E. Each offset is defined by an offset frequency, bandwidth, and optional RRC weighting. An offset actually defines two bands, one above the reference frequency and one below. Each band is used individually in the ACP calculation. RRC weighting may only be turned on or off for all offsets, but each offset may have its own RRC filter alpha. A filter alpha of 0 is the same as no RRC weighting.

The Offsets key accesses a menu that has a key for each offset, and also an Offset RRC weighting on/off key. Each offset key shows a summary of its current parameters. Pressing one of the Offset A|B|C|D|E keys accesses a menu for adjusting its parameters

Key Path	**Trace/Detector,ACP,Offsets**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Offset Freq

This key turns ACP analysis on or off for a selected offset, and sets the offset frequency (which is relative to the carrier frequency).

Key Path	**Trace/Detector,ACP,Offsets,Offset A|B|C|D|E**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:FREQuency <freq>,…`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:FREQuency?`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:STATe OFF|ON|0|1,…`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:STATe?`

Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:FREQ 1 MHZ,1 MHz,500 KHZ,500 KHz,1 MHZ CALC:VECT:TRAC1:ACP:OFFS:LIST:FREQ? :CALC:VECT:TRAC1:ACP:OFFS:LIST:STAT ON,OFF,OFF,ON,OFF

Notes	If you send fewer than 5 frequencies in the parameter list, then the remaining offsets frequencies are set to 0. You may send a single on/off parameter, or a comma-separated list of up to 5 parameters. These enable/disable each of the Offsets in sequence. Any remaining Offsets are disabled
Preset	3000000,0,0,0,0 1,0,0,0,0
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Offset Meas Noise BW

This key allows you to set the measurement noise bandwidth for the power measurement of a selected offset band.

Key Path	**Trace/Detector,ACP,Offsets,Offset A|B|C|D|E**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:BANDwidth|BWIDth:INTegration <bandwidth>,…` `:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:BANDwidth|BWIDth:INTegration?`
Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:BAND:INT 1 MHZ,2 MHZ,3 MHZ,4 MHZ,5 MHZ CALC:VECT:TRAC1:ACP:OFFS:LIST:BAND:INT?
Notes	If you send fewer than 5 bandwidth parameters in the list, then Measurement Noise Bandwidths for the remaining Offsets are set to 0.
Preset	1000000,0,0,0,0
State Saved	Saved in instrument state.
Min	–9.9e37
Max	9.9e37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Offset Filter Alpha

This key allows you to adjust the alpha of the RRC filter for the power measurement of the selected offset band.

Key Path	**Trace/Detector,ACP,Offsets,Offset A|B|C|D|E**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:FILTer:RRC:ALPHa <real>,…` `:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:FILTer:RRC:ALPHa?`
Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:FILT:RRC:ALPH 0.22,0.22,0.22,0.22,0.22 CALC:VECT:TRAC1:ACP:OFFS:LIST:FILT:RRC:ALPH?
Notes	You may send a single Filter Alpha for Offset A, or a comma-separated list of up to 5 Filter Alpha parameters. These are assigned in sequence to the Offsets. Alpha for any remaining Offsets will be set to 0.
Preset	0.35,0.35,0.35,0.35,0.35
State Saved	Saved in instrument state.
Min	0
Max	1.0
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Offset Relative Limit

This key enables you to turn on/off a relative limit test and set the limit for the selected offset. The test shows a failure if the power in either the upper or lower band at the selected offset exceeds the reference power plus the relative test limit. For example, if the test limit is –60, the reference power is –4.5 dBm, a test failure would be shown if the power in the lower or upper band exceeds –64.5 dBm.

Key Path	**Trace/Detector,ACP,Offsets**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:RCARrier <real1>,… :CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:RCARrier? :CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:RCARrier:TEST OFF|ON|0|1,… :CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:LIST:RCARrier:TEST?
Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR –50, –55, –60, –65, –80 CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR? CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR:TEST 1, 1, 1, 1, 1 CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR:TEST?
Notes	You may send a single Limit for Offset A, or a comma-separated list of up to 5 limit parameters. These are assigned in sequence to the Offset frequencies, with the remaining limits being set to 0. You may send a single on/off parameter, or a comma-separated list of up to 5 parameters. These turn the Limit Test on or off for each of the Offsets in sequence. For any remaining Offsets the Limit test will be turned off.
Preset	–120,–120,–120,–120,–120 0,0,0,0,0
State Saved	Saved in instrument state.
Min	50
Max	–200
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

RRC Weighting (All Offsets)

This key turns on or off RRC weighting for the power measurement for all offsets. If RRC weighting is turned on, but you wish to exclude RRC weighting for a particular offset, set its filter alpha to 0.

Key Path	**Trace/Detector,ACP,Offsets**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	:CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:FILTer:RRC:STATe OFF|ON|0|1 :CALCulate:<meas>:TRACe[1]|2|3|4:ACPower:OFFSet:FILTer:RRC:STATe?

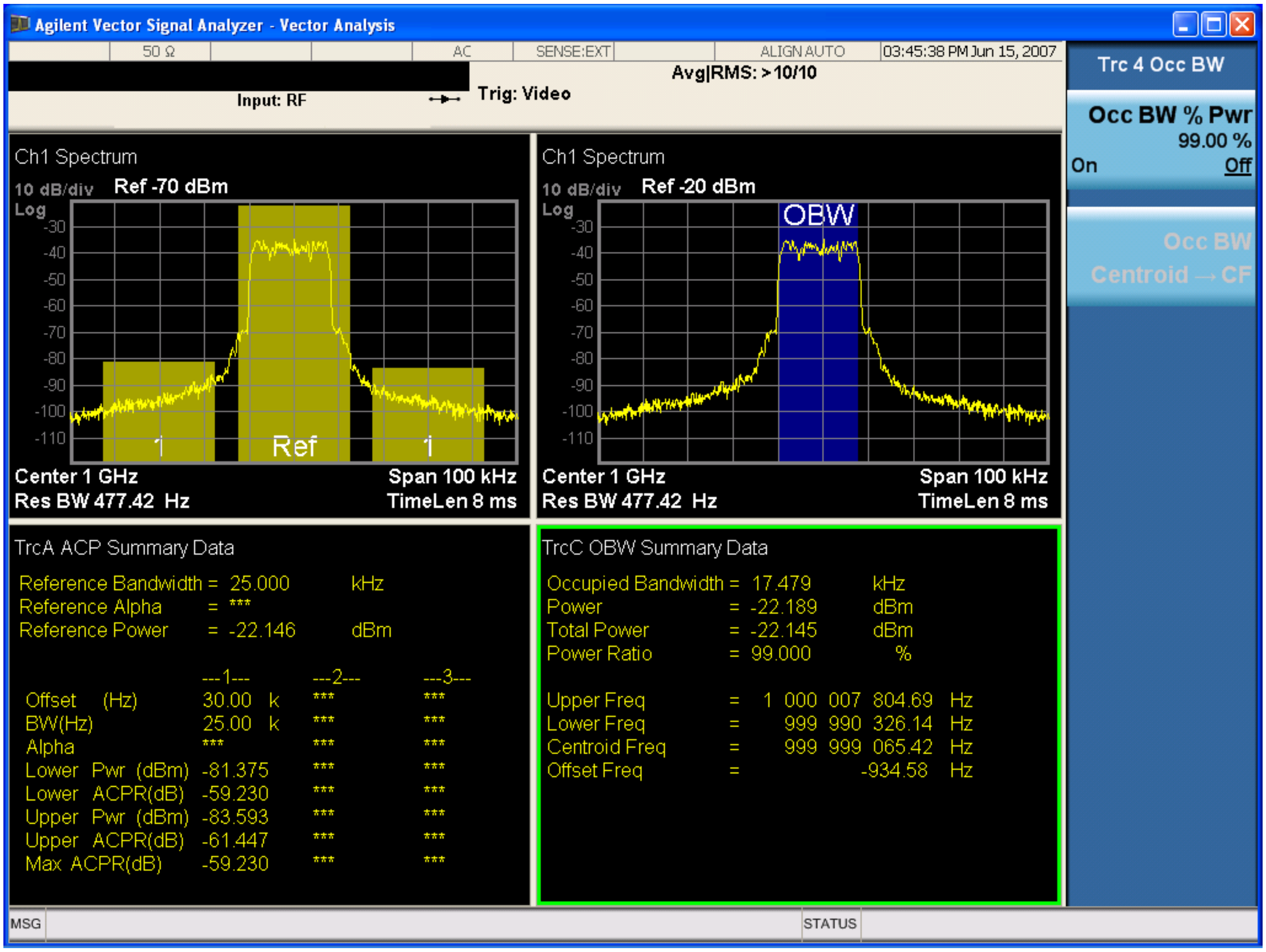
Example	CALC:VECT:TRAC1:ACP:OFFS:FILT:RRC:STAT ON CALC:VECT:TRAC1:ACP:OFFS:FILT:RRC:STAT?
Preset	0
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

OBW Setup (Occupied Bandwidth)

The occupied bandwidth (OBW) function finds and displays the band of frequencies that contain a specified percentage of the total power within the measurement span.

The OBW key accesses a menu of functions that allow you to define and turn on the OBW function on the selected trace.

An OBW measurement may be defined for each trace, although it will only be active on frequency-domain trace data. The band defined by the OBW measurement is shown as a blue bar overlaying the trace display. To see tabular data showing the frequencies of the band limits, the total power, etc. you may assign the OBW Summary (Trace n) to a different trace. For example, you can assign Spectrum data to trace 3, turn on OBW on trace 3, and assign the OBW Summary (Trace 3) to trace 4, as shown below.



The summary data may be retrieved programmatically using FETCh? or the CALCulate:<meas>:DATA:TABLe commands. See the Data Queries section under Common Functions for more details.

Key Path	**Trace/Detector**
Mode	VSA, LTE, LTETDD, IDEN
Readback Text	[On|Off, <num>%]
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

OBW Summary for Trace 1

Select trace for assignment of OBW Data.

See also: "OBW Setup (Occupied Bandwidth)" on page 463

Key Path	**Trace/Detector, Data, OBW, Channel n**

Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

OBW Summary for Trace 2

Select trace for assignment of OBW Data

See also: “OBW Setup (Occupied Bandwidth)” on page 463.

Key Path	**Trace/Detector, Data, OBW, Channel n**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

OBW Summary for Trace 3

Select trace for assignment of OBW Data

See also: “OBW Setup (Occupied Bandwidth)” on page 463.

Key Path	**Trace/Detector, Data, OBW, Channel n**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

OBW Summary for Trace 4

Select trace for assignment of OBW Data

See also: “OBW Setup (Occupied Bandwidth)” on page 463.

Key Path	**Trace/Detector, Data, OBW, Channel n**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

OBW Summary for Trace 5

Select trace for assignment of OBW Data

See also: “OBW Setup (Occupied Bandwidth)” on page 463.

Key Path	**Trace/Detector, Data, OBW, Channel n**

Mode	VSA

OBW Summary for Trace 6

Select trace for assignment of OBW Data

See also: "OBW Setup (Occupied Bandwidth)" on page 463.

Key Path	**Trace/Detector, Data, OBW, Channel n**
Mode	VSA

OBW Power

The OBW Power key is used to specify the percentage of power used to determine the occupied BW, and to turn the OBW function on or off for the selected trace.

Key Path	**Trace/Detector, OBW**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:PERCent <real>`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:PERCent?`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:STATe OFF|ON|0|1`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:STATe?`

Example	CALC:VECT:TRAC1:OBW:PERC 99 CALC:VECT:TRAC1:OBW:PERC? CALC:VECT:TRAC1:OBW:STAT ON CALC:VECT:TRAC1:OBW:STAT?
Notes	Parameter is interpreted as a percent, e.g., if you want the OBW to be 95% send 95, not 0.95
Couplings	None Controls the presence or absence of data in the OBW Summary table for the selected trace
Preset	99.0 0
State Saved	Saved in instrument state.
Min	0
Max	100
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00

OBW Centroid > CF

This softkey is used to copy the centroid of the occupied bandwidth to the Center Frequency. It only works if the currently selected trace has data compatible with the OBW function, and OBW is turned on.

This is a front-panel function only.

You can read the OBW centroid using the following SCPI-only query and use the result to set the center frequency.

Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:CENTroid?`
Example	CALC:VECT:TRAC1:OBW:CENT?
Notes	Query only. Returns NaN (9.91E+37) if the OBW function is not active for the selected trace, or is not supported for the trace data assigned to the selected trace.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

BW Limit

This turns on or off limit testing for the Occupied BW test for the selected trace, and allows you to define the limit. Test pass or fail status appears in the OBW Summary table associated with the trace.

Key Path	**Trace/Detector, OBW**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk

Remote Command	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:LIMit:FBLimit <freq>`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:LIMit:FBLimit?`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:LIMit[:TEST] OFF|ON|0|1`
	`:CALCulate:<meas>:TRACe[1]|2|3|4:OBWidth:LIMit[:TEST]?`

Example	CALC:VECT:TRAC1:OBW:LIMIT:FBL 10 MHZ CALC:VECT:TRAC1:OBW:LIMIT:FBL? CALC:VECT:TRAC1:OBW:LIMIT:TEST ON CALC:VECT:TRAC1:OBW:LIMIT:TEST?

Preset	1000000 0
State Saved	Saved in instrument state.
Min	1 Hz
Max	9.9e37 (Infinity) Hz
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Register

Accesses a menu that allows you to select registers for assignment of trace data.

Key Path	**Trace/Detector, Data**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Data 1

Select register 1 for assignment of trace data.

Key Path	**Trace/Detector, Data, Register**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Data 2

Selects register 1 for assignment of trace data.

Key Path	**Trace/Detector, Data, Register**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Data 3

Selects register 1 for assignment of trace data.

Key Path	**Trace/Detector, Data, Register**

Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Data 4

Selects register 1 for assignment of trace data.

Key Path	**Trace/Detector, Data, Register**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Data 5

Selects register 5 for assignment of trace data.

Key Path	**Trace/Detector, Data, Register**
Mode	VSA
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Data 6

Selects register 6 for assignment of trace data.

Key Path	**Trace/Detector, Data, Register**
Mode	VSA
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trace Indicator Info

This softkey allows you to get more information about why a trace indicator is showing. A trace indicator appears in the upper right corner of a trace display to announce exceptional conditions. When such an indicator is showing on the selected trace, pressing this key causes more information about the condition to appear in the message area. This is a front-panel only function. The SCPI commands for querying the Trace Indicator and the Trace Indicator Info for a particular trace are:

CALC:<meas>:DATA[1]|2|3|4:HEAD:STR? "TrcLedStr"

CALC:<meas>:DATA[1]|2|3|4:HEAD:STR? "TrcLedReason"

Key Path	**Trace/Detector**

Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trigger

Triggering is used to determine when a measurement should start taking data. There are several available trigger sources. For each trigger source, there are associated setup parameters. Typically, a trigger event is generated when a signal (or a characteristic of the signal) crosses a defined trigger level (or threshold) on a rising or falling slope. The measurement begins at a specified time delay from the trigger point. The delay may be negative, allowing pre-trigger data to be taken. Each trigger source has associated its own trigger level, slope, and delay settings.

Trigger Holdoff - Some form of trigger holdoff is available for most trigger types. Hold off can be defined in different ways, with possible variations depending on trigger slope setting.

Normal: This is the holdoff type that scopes typically use. After a trigger event, for the duration of the holdoff time, no additional trigger events are recognized.

Below Level: If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) after having been below the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) and then remains below the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

Above Level: If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) and then remains above the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) after having been above the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trig Reference Line

The trigger reference line appears (if enabled) when the trigger source is related to the measured signal. It shows the trigger level relative to the signal. This control allows you to show or hide the trigger reference line.

The trigger reference line, only appears on appropriately formatted time traces. For example, if Video (IF Envelope) trigger is selected, the trigger level line would appear on Main Time, Inst Main Time, or Raw Main Time traces that are formatted as Log Mag or Linear Mag.

Key Path	**Trigger**

Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:TRIGger[:SEQuence]:RLINe OFF|ON|0|1` `:TRIGger[:SEQuence]:RLINe?`
Example	TRIG:RLIN ON TRIG:RLIN?
Preset	1
State Saved	Saved in instrument state.
Range	Show | Hide
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Hardware Trigger

When the Data Source is Inputs, this trigger menu appears. The menu gives you a choice of trigger sources. Once you select a trigger source, you can branch to the setup parameters for that source.

Key Path	**Trigger**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:TRIGger:<meas>[:SEQuence]:SOURce IMMediate|VIDeo|EXTernal1` `:TRIGger:<meas>[:SEQuence]:SOURce?`
Example	TRIG:VECT:SOUR IMM TRIG:VECT:SOUR?
Notes	Video triggering is also known by some as IF Envelope or IF Magnitude triggering.
Preset	IMM
State Saved	Saved in instrument state.
Range	Free Run | Video (IF Envelope) | External 1
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Free Run

Free Run triggering, means each measurement scan starts as soon as possible, without regard to any signal characteristics or external triggering signal.

Key Path	**Trigger**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Video (IF Envelope)

Pressing this key, when it is not selected, selects Video (IF Envelope) triggering. The trigger condition is met when the magnitude of the signal you are measuring crosses the defined trigger level while satisfying the slope and holdoff conditions. (Specifically, the source for the trigger calculation is the IF signal, filtered only by the brickwall filter that defines the information bandwidth of the signal, Signal energy outside the information bandwidth does not affect the triggering.)

NOTE This is called Video triggering due to its similarity with swept analyzer zero span measurements being triggered on the video signal. However, in this case there is no video signal. Since the trigger condition applies to the full IF signal, this is also called IF envelope triggering.

If Video triggering is already selected then pressing this softkey accesses the video trigger setup functions, and changes the active function to Video Trigger Level.

Key Path	**Trigger**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trigger Level

Sets a level (in volts) that the magnitude of the IF signal must cross (with the correct slope) in order to generate a trigger. (Holdoff conditions must also be met.)

Key Path	**Trigger,Video**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:TRIGger[:SEQuence]:VIDeo:LEVel <voltage>` `:TRIGger[:SEQuence]:VIDeo:LEVel?`
Example	TRIG:VID:LEV 10 MV TRIG:VID:LEV?
Notes	:TRIGger[:SEQuence]:IF:LEVel <voltage> may be used as an alias
Preset	10 mV

State Saved	Saved in instrument state.
Min	0
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trig Slope

Controls the trigger polarity. Positive means the trigger occurs when the rising magnitude crosses the trigger level. Negative means the trigger occurs when the falling magnitude crosses the trigger level.

Key Path	**Trigger,Video**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:TRIGger[:SEQuence]:VIDeo:SLOPe POSitive|NEGative` `:TRIGger[:SEQuence]:VIDeo:SLOPe?`
Example	TRIG:VID:SLOP POS TRIG:VID:SLOP?
Notes	:TRIGger[:SEQuence]:IF:SLOPe POSitive|NEGative may also be used
Preset	POS
State Saved	Saved in instrument state.
Range	Pos | Neg
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trig Delay

Controls the time delay from the trigger point to the actual start of the measurement data. This can be negative to get pre-trigger data.

Key Path	**Trigger,Video**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	:TRIGger[:SEQuence]:VIDeo:DELay <time> :TRIGger[:SEQuence]:VIDeo:DELay? :TRIGger[:SEQuence]:VIDeo:DELay:STATe OFF|ON|0|1 :TRIGger[:SEQuence]:VIDeo:DELay:STATe?

Example	TRIG:VID:DEL 10 MS TRIG:VID:DEL? TRIG:VID:DEL:STAT ON TRIG:VID:DEL:STAT?
Notes	:TRIGger[:SEQuence]:IF:DELay <time> may be used as an alias :TRIGger[:SEQuence]:IF:DELay:STATe may also be used as an alias
Preset	0 OFF
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trig Holdoff

Sets the trigger holdoff time.

.

Key Path	**Trigger,Video**
Mode	VSA, LTE, LTETDD, IDEN

Remote Command	`:TRIGger[:SEQuence]:VIDeo:HOLDoff <time>`
	`:TRIGger[:SEQuence]:VIDeo:HOLDoff?`
	`:TRIGger[:SEQuence]:VIDeo:HOLDoff:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:VIDeo:HOLDoff:STATe?`

Example	TRIG:VID:HOLD 1 US TRIG:VID:HOLD? TRIG:VID:HOLD:STAT ON TRIG:VID:HOLD:STAT?
Notes	:TRIGger[:SEQuence]:IF:HOLDoff may be used as an alias :TRIGger[:SEQuence]:IF:HOLDoff:STATe may be used as an alias
Preset	0 OFF
State Saved	Saved in instrument state.
Min	–9.9E+37

Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Holdoff Type

Sets the trigger holdoff type.

Some form of trigger holdoff is available for most trigger types. Hold off can be defined in different ways, with possible variations depending on trigger slope setting.

Below Level: If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) after having been below the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) and then remains below the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

Above Level: If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) and then remains above the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) after having been above the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

Key Path	**Trigger,Video**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	:TRIGger[:SEQuence]:VIDeo:HOLDoff:TYPE BELow|ABOVe :TRIGger[:SEQuence]:VIDeo:HOLDoff:TYPE?
Example	TRIG:VID:HOLD:TYPE BEL TRIG:VID:HOLD:TYPE?
Notes	:TRIGger[:SEQuence]:IF:HOLDoff:TYPE can be used as an alias
Preset	BEL
State Saved	Saved in instrument state.
Range	Below Level | Above Level
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

External 1

Pressing this key, when it is not selected, selects the signal on the Trigger 1 input as the trigger signal. The trigger condition is met when the level of the external trigger signal crosses the defined trigger level while satisfying the slope and holdoff conditions.

Note that currently, the VSA based measurements do not support External 2 triggering.

If External 1 triggering is already selected then pressing this softkey accesses the external 1 trigger setup functions, and changes the active function to Ext 1 Trigger Level.

Key Path	**Trigger**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trigger Level

Sets a level (in volts) that the Trigger signal must cross (with the correct slope) in order to generate a trigger. (Holdoff conditions must also be met.)

Key Path	**Trigger, External 1**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:TRIGger[:SEQuence]:EXTernal1:LEVel <voltage>` `:TRIGger[:SEQuence]:EXTernal1:LEVel?`
Example	TRIG:EXT1:LEV 10 MV TRIG:EXT1:LEV?
Preset	1 V
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trig Slope

Controls the trigger polarity. Positive means the trigger occurs on a rising edge. Negative means the trigger occurs on a falling edge.

Key Path	**Trigger, External 1**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:TRIGger[:SEQuence]:EXTernal1:SLOPe POSitive|NEGative` `:TRIGger[:SEQuence]:EXTernal1:SLOPe?`
Example	TRIG:EXT1:SLOP POS TRIG:EXT1:SLOP?
Preset	POS
State Saved	Saved in instrument state.

Range	Pos | Neg
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trig Delay

Controls the time delay from the trigger point to the actual start of the measurement data. This can be negative to get pre-trigger data.

Key Path	**Trigger, External 1**
Mode	VSA, LTE, LTETDD, IDEN

Remote Command	`:TRIGger[:SEQuence]:EXTernal1:DELay <time>`
	`:TRIGger[:SEQuence]:EXTernal1:DELay?`
	`:TRIGger[:SEQuence]:EXTernal1:DELay:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:EXTernal1:DELay:STATe?`

Example	TRIG:EXT1:DEL 10 MS TRIG:EXT1:DEL? TRIG:EXT1:DEL:STAT ON TRIG:EXT1:DEL:STAT?
Preset	0 0
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Trig Holdoff

Sets the trigger holdoff time.

Key Path	**Trigger, External 1**
Mode	VSA, LTE, LTETDD, IDEN

Remote Command	`:TRIGger[:SEQuence]:EXTernal1:HOLDoff <time>`
	`:TRIGger[:SEQuence]:EXTernal1:HOLDoff?`
	`:TRIGger[:SEQuence]:EXTernal1:HOLDoff:STATe OFF|ON|0|1`
	`:TRIGger[:SEQuence]:EXTernal1:HOLDoff:STATe?`

Example	TRIG:EXT1:HOLD 1 US TRIG:EXT1:HOLD? TRIG:EXT1:HOLD:STAT ON TRIG:EXT1:HOLD:STAT?
Preset	0 0
State Saved	Saved in instrument state.
Min	–9.9E+37
Max	9.9E+37
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Holdoff Type

Sets the trigger holdoff type. See

Some form of trigger holdoff is available for most trigger types. Hold off can be defined in different ways, with possible variations depending on trigger slope setting.

Below Level: If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) after having been below the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) and then remains below the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

Above Level: If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) and then remains above the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) after having been above the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed.

Key Path	**Trigger, External 1**
Mode	VSA, LTE, LTETDD, IDEN
Remote Command	`:TRIGger[:SEQuence]:EXTernal1:HOLDoff:TYPE BELow|ABOVe` `:TRIGger[:SEQuence]:EXTernal1:HOLDoff:TYPE?`
Example	TRIG:EXT1:HOLD:TYPE BEL TRIG:EXT1:HOLD:TYPE?
Preset	BEL
State Saved	Saved in instrument state.
Range	Below Level | Above Level
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00

View/Display

The View/Display menu contains the Display branch key, which allows you to set many display properties. Many View Preset softkeysappear under this menu. These set up measurement-specific views, which are described in individual measurements. A view in this application is simply a preset; i.e., a choice of layout, trace data assignment, and trace formatting and scaling. After a view preset is performed, the resulting arrangement can then be changed by any available trace manipulation functions or by changing the layout. All measurements have a default view that is used when they are first started, and the first listed preset view will restore that arrangement without otherwise affecting the measurement.

This menu contains keys that allow control over the way data is displayed. The Layout key is described here. Other keys specific to measurements will be described in their own descriptions.

Key Path	**Front Panel**
Mode	VSA, LTE, LTETDD, IDEN
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Layout

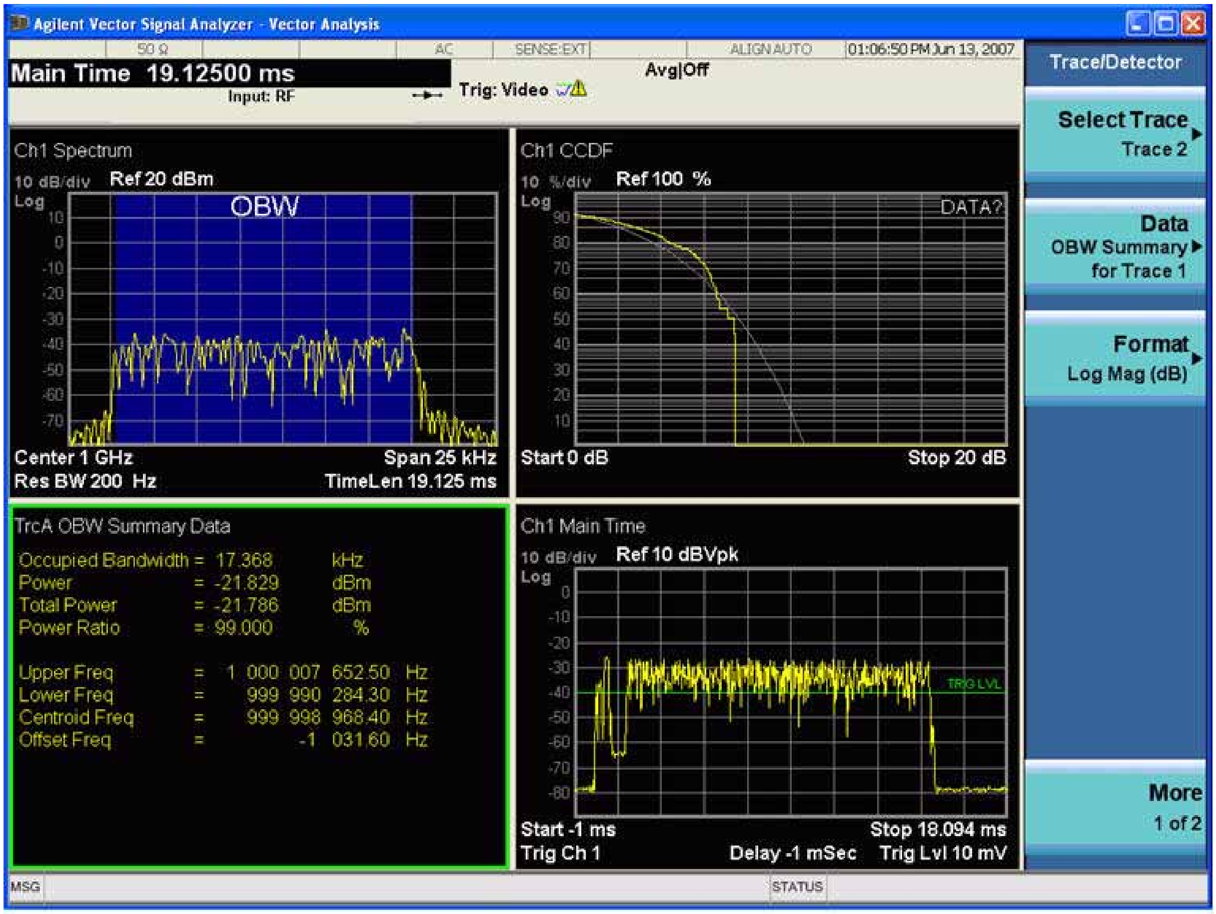
This key allows you to choose the number and position of windows on the screen. Each window contains one trace. The selected trace is always visible and its window outlined in green. The Window zoom key toggles between multiple windows and a single window mode without changing the setting for Layout.

Single layout has one window.

Stack 2 layout has two windows, one on top of the other, that display either traces 1 (top) and 2 (bottom) or traces 3 and 4. The pair that is showing always includes the selected trace.

Stack 3 layout has three windows that display, top to bottom, traces 1, 2, 3 or traces 2, 3, 4.

Grid 2x2 layout has 4 windows, arranged 2x2.They display (in order top to bottom, left to right) traces 1, 2, 3, and 4.

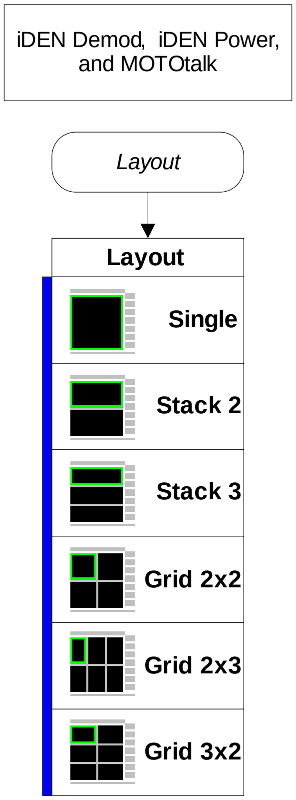


Grid 2x2 layout with Trace 2 selected

There are two other layouts that are available for iDEN Power, iDEN Demod and MOTOTalk measurements, since these allow 6 traces.

Grid 2x3 layout has 2 rows of 3 windows that display all 6 traces in order, top to bottom, them left to right.

Grid 3x2 layout has 3 rows of 2 windows that display all 6 traces in order, top to bottom, them left to right.



Key Path	**View/Display**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	:DISPlay:<meas>:WINDow:FORMat SINGle|TWO|TRI|QUAD :DISPlay:<meas>:WINDow:FORMat? For iDEN Power, iDEN Demod and MotoTalk measurements: :DISPlay:<meas>:WINDow:FORMat SINGle|TWO|TRI|QUAD|GR2X3|GR3X2 :DISPlay:<meas>:WINDow:FORMat?
Example	DISP:VECT:WIND:FORM TWO DISP:IPOW:WIND:FORM GR2X3 DISP:VECT:WIND:FORM?
Couplings	If the window is currently zoomed, selecting a layout (even the current one) will switch it to tiled mode.
Preset	TWO|QUAD|QUAD|QUAD|QUAD|QUAD|QUAD|QUAD|GR2X3|TRI
State Saved	Saved in instrument state.
Range	Single | Stack 2 | Stack 3 | Grid 2x2 | Grid 2x2 | Grid 2x3 | Stack 3

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Remote SCPI Commands and Data Queries

Remote SCPI Results described in this section include:

“:READ and :FETCh Commands” on page 482

“:CALCulate:DATA” on page 486

“:CALCulate:DATA:RAW” on page 488

“:CALCulate:DATA:RAW:COMPlex” on page 488

“:CALCulate:DATA:POINts commands” on page 488

“:CALCulate:DATA:TABL commands” on page 489

“:CALCulate:DATA:HEADer commands” on page 493“IQ Data Transfers ” on page 495

VSA based Measurements produce a rich variety of results which may be displayed in any of 4 traces. A result may consist of an array of X,Y trace data that is typically shown as a graph, or scalar results that are displayed as a table. The Symbol/Error result that is part of many demodulation measurements actually displays both a trace table (the error statistics) and trace data (the symbol information, which is not graphed but listed). The CALC:<meas>:DATA<n> commands allow you to retrieve any trace data or trace table. This family of commands also allow you to get information about the names of data results available and the units associated with them, as well as names and results of meta-data associated with traces.

Selected results are available via the FETCh and READ SCPI interfaces. These commands refer to data results by arbitrary index number rather than by trace number.

:READ and :FETCh Commands

The SCPI MEASure, READ, and FETCh are typically offered by applications with focus on manufacturing test, where a fixed set of desired results is known in advance and seldom changes. The VSA based measurements are many, due to a focus on development. Thus, for most VSA based measurements there is no standard configuration that will yield a useful measurement 90% of the time. Thus, the MEASure function will not be offered for most measurements in the VSA Application. However, READ and FETCh may be implemented for select results. Note that these results will also still be available using the CALC:<meas>:DATA:TABLe family of commands.

ACP and OBW are available in all VSA based measurements. To retrieve the ACP or OBW data, the function must be enabled on a frequency-domain trace and the associated summary data table must be assigned to another trace. Note however, the index n in the following commands is not trace number, but an index picked out of the tables shown below.

```
:FETCh:<meas>[n]?
```

```
:READ:<meas>[n]?
```

The results available for various values of n are shown below:

Condition	N	Results Returned
Mode = VSA | LTE | IDEN	Not specified or n=1	Reserved for selected results of VSA measurements. If not used for a particular measurement, no result is returned and error –114 Header suffix out of range is generated
Mode = VSA | LTE | IDEN	2 – 50	Reserved for selected results of VSA measurements. If not used for a particular measurement, no result is returned and error –114 Header suffix out of range is generated

Condition	N	Results Returned
Mode = VSA | LTE | IDEN, ACP on trace 1	51	ACP Summary for trace 1 Returns 28 comma-separated scalar results, corresponding to the swept ACP results where possible; n/a elsewhere: Returns 28 comma-separated scalar results, in the following order. 1. 0.0 2. Total carrier power (dBm) (same as item 4, because only 1 carrier supported) 3. 0.0 4. Reference carrier power (dBm) 5. Lower offset A - relative power (dB) 6. Lower offset A - absolute power (dBm) 7. Upper offset A - relative power (dB) 8. Upper offset A - absolute power (dBm) 9. Lower offset B - relative power (dB) 10. Lower offset B - absolute power (dBm) 11. Upper offset B - relative power (dB) 12. Upper offset B - absolute power (dBm) ... 21. Lower offset E - relative power (dB) 22. Lower offset E - absolute power (dBm) 23. Upper offset E - relative power (dB) 24. Upper offset E - absolute power (dBm) 25. n/a 26. n/a 27. n/a 28. n/a 29. Overall ACP test result summary (0 indicates at least 1 failure, 1 indicates all passed) If any result is not available, NaN (9.91 E 37) is returned. This can happen if ACP is turned off (all results unavailable), or when an offset is entirely off-screen. In the case where it is partially off-screen, the measured result is returned, even though its validity is questionable.
Mode = VSA | LTE | IDEN, ACP on trace 2	52	ACP Summary for trace 2 see list for trace 1 summary

Condition	N	Results Returned
Mode = VSA | LTE | IDEN, ACP on trace 3	53	ACP Summary for trace 3 see list for trace 1 summary
Mode = VSA | LTE | IDEN, ACP on trace 4	54	ACP Summary for trace 4 see list for trace 1 summary
Mode = VSA | LTE | IDEN, ACP on trace 5	55	ACP Summary for trace 5 see list for trace 1 summary
Mode = VSA | LTE | IDEN, ACP on trace 6	56	ACP Summary for trace 6 see list for trace 1 summary
	57–60	no result returned; error –114, Header suffix out of range generated
Mode = VSA | LTE | IDEN, OBW on trace 1	61	OBW Summary for trace 1 Returns 9 comma-separated scalar results, corresponding exactly to the items in the OBW Summary trace: 1. OBW (Hz) 2. Pwr (dBm) 3. Total Pwr (dBm) 4. Pwr Ratio (no unit, E.g. 0.99) 5. OBW upper freq (Hz) 6. OBW lower freq (Hz) 7. Centroid freq (Hz) 8. Offset freq (Hz) 9. OBW Test Result (0 for fail, 1 for pass) If the results are not available, NaN (9.91 E 37) is returned.
Mode = VSA | LTE | IDEN, OBW on trace 2	62	OBW Summary for trace 2 see list for trace 1 summary
Mode = VSA | LTE | IDEN, OBW on trace 3	63	OBW Summary for trace 3 see list for trace 1 summary
Mode = VSA | LTE | IDEN, OBW on trace 4	64	OBW Summary for trace 4 see list for trace 1 summary

Condition	N	Results Returned
Mode = VSA | LTE | IDEN, OBW on trace 5	65	OBW Summary for trace 5 see list for trace 1 summary
Mode = VSA | LTE | IDEN, OBW on trace 6	66	OBW Summary for trace 6 see list for trace 1 summary

Key Path	**Remote Command Only**
Mode	LTE, LTETDD, IDEN, VSA

:CALCulate:DATA

Once measurement data result is assigned to a trace, the data can be retrieved by using one of the following commands (where <n> is the trace number and <meas> is the current VSA based measurement).

:CALC:<meas>:DATA<n>?

:CALC:<meas>:DATA<n>:RAW?

The first form of the command retrieves the data as formatted on the display. For example, if (in a vector measurement) you have the Spectrum result in LogMag format on trace 1, then

:CALC:VECT:DATA1?

will return an array of spectrum amplitude (Y data) in units of dBm, and

:CALC:VECT:DATA1:RAW?

will return the Y data in its underlying units of Volts (peak) squared.

(To get data from displayed tables, see CALCulate:DATA:TABLe commands below.)

The CALC:<meas>:DATA commands get data from traces. There are many results available from a VSA based measurement, and only 4 traces in which to view them. View Preset commands are one way of displaying frequently-used results in standard trace locations. Or you may assign any measurement result to any trace using the softkeys under Trace/Detector, Data. The SCPI command for doing this is:

:DISP:<meas>:TRAC<n>:FEED "<data_name>"

For example, if (in a vector measurement) you wish to view the CCDF result in trace 4, you send:

:DISP:VECT:TRAC4:FEED "CCDF1"

(If the measurement has not run yet, use INIT:IMM to run it.) Then the CCDF data may be retrieved using

CALC:VECT:DATA4?

or

CALC:VECT:DATA4:RAW?

See the Data command (under Trace/Detector) and the View Preset commands (under View/Display) in this document as well as the PDs for each VSA based measurement for more details on assigning data to traces.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4? [Y|X|XY[,OFF|ON|0|1]]`
Example	CALC:VECT:DATA1? CALC:VECT:DATA1? Y,ON CALC:VECT:DATA1? X CALC:VECT:DATA1? XY
Notes	Query only. This retrieves the data in the designated trace as displayed. E.g., if Trace 1 is assigned Spectrum data and formatted as LogMag, then :CALC:VECT:DATA1? will return the Y data in dBm. If the X axis is scaled to show only a portion of the trace data, only the data shown will be returned. The numeric format of the returned data is controlled by FORMat[:TRACe][:DATA] command The optional parameters control what data is returned. :CALC:VECT:DATA1? Y is the same as :CALC:VECT:DATA1? with no parameter. It returns an array of Y values. :CALC:VECT:DATA1? X returns an array of X values that correspond to the Y values above. :CALC:VECT:DATA1? XY returns interleaved X and Y data. I.e.: <x1><y1><x2><y2>… Normally, this command only returns the data between the current X scale limits. If the optional ",OFF" or ",0" switch is included at the end of the command, then all data is returned (regardless of X scaling or the state of All Frequency Points). Note: the X and Y parameters in this command refer to the display's horizontal and vertical axes. Normally the X axis is the independent variable, but if the display format is Constellation or IQ, then CALC:<meas>:DATA<n>? [Y] returns the imaginary part of the data, and CALC:<meas>:DATA<n>? X returns the real part of the data. If you want the values of the independent variable, change to a non-vector format (such as Log Mag) and use CALC:<meas>:DATA<n>? X
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

:CALCulate:DATA:RAW

Retrieves trace data in its underlying units, before the formatting calculation that converts it to displayed units. Underlying units are typically Volts peak (for signal results) or Volts peak squared (for power results). All data points are returned, whether or not they are displayed.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:RAW?`
Example	CALC:VECT:DATA1:RAW?
Notes	Query only. This retrieves the unformatted Y data in the designated trace. If Y data is complex, it is returned as <y_real1><y_imag1><y_real2><y_imag2> etc.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

:CALCulate:DATA:RAW:COMPlex

This command is used to determine if the data retrieved by CALC:<meas>:DATA:RAW<n>? is complex.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:RAW:COMPlex?`
Example	CALC:VECT:DATA1:RAW:COMP?
Notes	Query only. Returns 1 if the trace data is complex, 0 if it is real.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

:CALCulate:DATA:POINts commands

This query returns the number of points that will be returned by

CALCulate:<meas>:DATA<n>?

X axis scaling and whether All Frequency Points is on or off can affect this number.

NOTE For the CALCulate:<meas>:DATA<n>? XY command there are 2 numbers returned per data point.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:POINts? [OFF|ON|0|1]`
Example	CALC:VECT:DATA1:POINts?
Notes	Query only. Use the optional "OFF|0" parameter to determine the number of points that will be returned by the the optional command form: :CALCulate:<meas>:DATA<n>? Y|X|XY,OFF|0 Note that this is points, not array size. If the XY parameter is included, there are 2 numbers returned per point. (ON or 0, which means use the X-scaled version, is the default and the result is the same as if the parameter is omitted).
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:RAW:POINts?`
Example	CALC:VECT:DATA1:RAW:POINts?
Notes	Query only.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

:CALCulate:DATA:TABL commands

Query Table Data as Number

The following query gets data from a table shown in the designated trace. Tables shown on the display typically have the name of a parameter followed by its measured value

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN

Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:TABLe[:NUMBer]? [<string>]`
Example	CALC:DDEM:DATA2:TABL? "Obw"
Notes	Query only. If sent without a string specifier, this returns the entire table for the designated trace.If sent with a string specifier, returns a specific table entry in the designated trace. The string specifier must be delimited by single or double quotes. A list of valid strings can be obtained using CALC:<meas>:DATA:TABL:NAM? If an invalid string is sent, an error is generated. The returned results are in numeric format, under control of the FORMat[:TRACe][:DATA] command. For table data that is non-numeric, NaN is returned. To get the value of these data, use the CALC:<meas>:DATA2:TABL:STR? command
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Query Table Data as String

Some tables have string data. The above Trace Table Data query cannot return it, and sends NaN in its place. Here is a form of Trace Table Data query that can return string data from tables.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:TABLe:STRing? [<string>]`
Example	CALC:DDEM:DATA2:TABL:STR? "Obw"
Notes	Query only. If sent without a string specifier, this returns the entire table for the designated trace, in comma-separated format. If sent with a string specifier, returns a specific table entry in the designated trace. The string specifier must be delimited by single or double quotes. A list of valid strings can be obtained using CALC:<meas>:DATA:TABL:NAM? If an invalid string is sent, an error is generated.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Query Table Names

The following query returns a comma-separated list of names of the table data entries for the designated trace. Each of names may be used (surrounded by quotes or double quotes) as a parameter in the Trace Table Data commands. The names appear in the same order as the corresponding data values returned by the CALC:<meas>:DATA<n>:TABL[:NUMB|STR]? query.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:TABLe:NAMes?`
Example	CALC:VECT:DATA1:TABL:NAM?
Notes	Query only. This retrieves the names of the table entries for the designated trace. Each of these names may be used in the CALC:<meas>:DATA:TABL? '<name>' command to access a single table entry.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Query Table Units

The following query returns a comma-separated list of all the units for the table data entries for the designated trace. If a data result is unitless, an empty string appears in the list for that result. The units appear in the same order as the corresponding data values returned by the CALC:<meas>:DATA<n>:TABL[:NUMB|STR]? query.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:TABLe:UNIT?`
Example	CALC:VECT:DATA1:TABL:UNIT?
Notes	Query only. This retrieves a list of units for table entries for the designated trace. The units are given in the order that the entries are sent from the :CALC:<meas>:DATA:TABL? command.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

The following table data is available in all measurements when the ACP function is turned on and the associated summary table is shown in a trace:

Result name	**Displayed Unit**	**Remote Name**	**Remote Unit**
Reference Bandwidth	Hz	RefBw	Hz
Reference Alpha		RefAlpha	

Result name	Displayed Unit	Remote Name	Remote Unit
Reference Power	dBm	RefPwr	Vrms^2
Offset	Hz	Offset1, Offset2, Offset3, Offset4, Offset5	Hz
BW	Hz	Bw1, Bw2, Bw3, Bw4, Bw5	Hz
Alpha		Alpha1, Alpha2, Alpha3, Alpha4, Alpha5	
Lower Pwr	dBm	LowPwr1, LowPwr2, LowPwr3, LowPwr4, LowPwr5	Vrms^2
Lower ACPR	dB	LowRatio1, LowRatio2, LowRatio3, LowRatio4, LowRatio5	
Upper Pwr	dBm	HiPwr1, HiPwr2, HiPwr3, HiPwr4, HiPwr5	Vrms^2
Upper ACPR	dB	HiRatio1, HiRatio2, HiRatio3, HiRatio4, HiRatio5	
Max ACPR	dB	MaxRatio1, MaxRatio2, MaxRatio3, MaxRatio4, MaxRatio5	

The following table data is available in all measurements when the OBW function is turned on and the associated summary table is shown in a trace:

Result name	Displayed Unit	Remote Name	Remote Unit
Occupied Bandwidth	Hz	Obw	Hz
Power	dBm	Pwr	Vrms^2
Total Power	dBm	TotalPwr	Vrms^2
Power Ratio	%	PwrRatio	
Upper Freq	Hz	ObwUpper	Hz
Lower Freq	Hz	ObwLower	Hz
Centroid Freq	Hz	Centroid	Hz
Offset Freq	Hz	Offset	Hz

:CALCulate:DATA:HEADer commands

Query Header Names

The following query returns a comma-separated list of all the header names associated with the designated trace. Each of the names may be used (surrounded by quotes or double quotes) as a parameter in the other CALC:<meas>:DATA<n>:HEAD queries.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:HEADer:NAMes?`
Example	CALC:VECT:DATA1:HEAD:NAM?
Notes	Query only. Returns a comma-separated list of header names.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Query Header Type

This query returns whether the designated header on the designated trace may be queried as a number, or by a string only.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:HEADer:TYPE? <string>`
Example	CALC:VECT:DATA1:HEAD:TYPE? 'XDelta'
Notes	Query only. This retrieves the type of the named header for the designated trace. The name (delimited by single or double quotes) is one of the names returned by the CALC:<meas>:DATA:HEAD:NAMes? If a valid header name is passed in, the return value from this query is either STR or NUMB. NONE is returned if there is no such header.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Query Header as String

This query gets a header by name from the designated trace and returns its value as a string.

Key Path	**SCPI only**

Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:HEADer:STRing? <string>`
Example	CALC:VECT:DATA1:HEAD:STR? 'WindowType'
Notes	Query only. This retrieves the named header for the designated trace. The name (delimited by single or double quotes) is one of the names returned by the CALC:<meas>:DATA:HEAD:NAMes? The return value is a string. If the requested header value is a numeric, or if there is no such header, an empty string is returned..
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

Query Numeric Header

This query gets a numeric header by name from the designated trace and returns its value in a format determined by the last FORM command.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`:CALCulate:<meas>:DATA[1]|2|3|4:HEADer[:NUMBer]? <string>`
Example	CALC:VECT:DATA1:HEAD? 'XDelta'
Notes	Query only. This retrieves the named header for the designated trace. This form of the HEAD? query is for headers whose type is NUMB (as determined by :CALC:<meas>:DATA:HEAD:TYPE?) The name parameter (delimited by single or double quotes) is one of the names returned by the CALC:<meas>:DATA:HEAD:NAMes? The format of the return data is determined by the FORMat[:TRACe][:DATA] command. If used to query a header whose type is STR, or there is no such header, NaN (9.91e37) is returned
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

:CALC:CLIMits:FAIL?

If one or more ACP or OBW limit tests are active, then the CALC:CLIMits:FAIL? command will return the aggregate pass or fail status.

IQ Data Transfers

Fast capture/transfer of a large amount of IQ data is supported over SCPI. To do this, first set up the desired measurement range, center frequency, span, triggering, etc. Use a time length that is convenient for setting up the measurement. The time length for the captured data will be set indirectly as shown below.

To perform the capture, a typical SCPI sequence is as follows:

`FCAP:LENG <num_samples>`

This command sets the length for the next capture in samples. The sample rate is proportional to the current span, and can be determined by a SCPI query, e.g., in the Vector measurement the query:

`VECT:SWE:ISR?`

returns the input sample rate. Multiply the time length desired for the captured data by this sample rate to get the number of samples to needed.

`INIT:FCAP`

will pause the current measurement and start capturing IQ data using the current setup and trigger conditions. (The instrument front panel display will not change nor show the captured data.)

To read the captured data via SCPI in blocks, set the read block size using the command:

`FCAP:BLOC <num_points_per_read_block>`

The maximum read block size is typically less than the total fast capture buffer size, and can be determined by the query "FCAP:BLOC? MAX". Now you can repeatedly use the following query to read out successive blocks of data:

`FETC:FCAP?`

The returned data is formatted according to the most recent :FORMat[:DATA] and :FORMat:BORDer commands. A read pointer that indicates the next sample to be transferred is advanced automatically following each FETC:FCAP? query. This pointer position can be read or manually set via the SCPI commands

`FCAP:POIN?`

`FCAP:POIN <read_pointer_position>`

The fast capture data may be read as long as you use only the commands to set read block size and pointer position, or queries that return the state of the current measurement. The capture data is cleared by any command that changes the measurement state or initiates a new measurement, or via SCPI device clear, or :ABORT commands.

Fast capture data word size may be set to either 32 bit or 64 bit via the FCAP:WLEN command. This allows you to trade off precision for total capture length.

NOTE	When the word size is 32 bit, points can only be retrieved on even sample number boundaries, i.e., the pointer and block length should be even numbers. Therefore, when the word size is set to auto, it is recommended that the pointer and block size be only set to even numbers.

Fast Capture Length

Sets the length of the SCPI Fast Capture in samples (points)

Query returns the most recent length setting.

Remote Command	`[:SENSe]:FCAPture:LENGth <integer>` `[:SENSe]:FCAPture:LENGth?`
Example	FCAP:LENG 1000 FCAP:LENG?
Initial S/W Revision	A.04.00
Mode	VSA
Notes	This is affected by the IF path currently used, which may in turn be affected by span. It is also affected by the internal Fast Capture Word Length. The current maximum fast capture length may be found by using the query: `FCAP:LENG? MAX` Changing the Capture Length after initiating a fast capture clears the capture memory in preparation for a new fast capture of a different length. No Front panel access; SCPI only
Preset	1048576 Samples
Min	2
Max	536 870 912 Samples for internal 40 MHz and 140 MHz options with FCAP:WLEN BIT32

Fast Capture Word Length

Allows choice of internal fast capture word length. Shorter word length allows twice the time length to be captured, at the cost of quantization noise. Note that this does not affect the format of data returned by FETCh:FCAPture, only the internal representation.

Remote Command	`[:SENSe]:FCAPture:WLENgth AUTO|BIT32|BIT64` `[:SENSe]:FCAPture:WLENgth?`
Example	FCAP:WLEN AUTO FCAP:WLEN?
Initial S/W Revision	A.04.00
Mode	VSA
Notes	No Front panel access; SCPI only.
Preset	AUTO

Initiate Fast Capture

Waits for the sweep to trigger and then captures the fast capture data. Sweep is then set to pause. The amount of data captured is controlled by the Fast Capture Length command (FCAP:LENG).

Remote Command:	:INITiate:FCAPture
Example:	INIT:FCAP
Notes:	Returns when the capture is complete. No Front panel access; SCPI only This command resets the Fast Capture Pointer to 0
Initial S/W Revision:	A.04.00
Mode	VSA

Fast Capture Block

Sets the block size for the Fast Capture transfer in samples (points). This is the number of points that will be returned from the Capture buffer by the FETC:FCAP? command.

Query returns most recent block size setting.

Remote Command	[:SENSe]:FCAPture:BLOCk <integer> [:SENSe]:FCAPture:BLOCk?
Example	FCAP:BLOC 100 FCAP:BLOC?
Initial S/W Revision	A.04.00
Mode	VSA
Notes	No Front panel access. SCPI only.
Preset	1024 Samples
Min	0
Max	131072 or Fast Capture Length, whichever is smaller

Fast Capture Pointer

Sets the pointer position for the Fast Capture transfer in samples (points). The pointer is incremented by the block size each time the fetch is performed. Preset value (0) is the first sample in the record. Thus repetitive fetches will result in contiguous data without needing to increment the pointer over SCPI. Query returns most recent pointer setting.

Remote Command	[:SENSe]:FCAPture:POINter <integer> [:SENSe]:FCAPture:POINter?

Example	FCAP:POIN 100 FCAP:POIN?
Initial S/W Revision	A.04.00
Mode	VSA
Notes	INIT:FCAP or FCAP:ABOR resets the pointer to 0. No front panel access; SCPI only.
Preset	0 Samples
Min	0
Max	Must be less than the Fast Capture length

Fetch Fast Capture

Transfers the block of data starting at the pointer. The number of samples transferred is set with the block size. The pointer is incremented by the block size after the fetch.

Mode	VSA
Remote Command	`:FETCh:FCAPture?`
Example	FETC:FCAP?
Notes	The returned data is formatted according to the most recent :FORMat[:DATA] and :FORMat:BORDer commands. If the read pointer position plus read block size exceeds the Fast Capture Length, only the data between the pointer and the end of the fast capture buffer are returned, and error –200 is reported.. If Fetch is attempted before an INIT:FCAP (or if the captured data is cleared by some other operation ,e.g. REC; error –230 is reported and no data is returned. No front panel access; SCPI only.
Initial S/W Revision	A.04.00

Input Sample Rate Query

This SCPI only query returns the complex sample rate in Hz for the current VXA measurement setup conditions. The sample rate can be used to convert between time and number of sample points when using the Fast Capture feature.

Sample rate depends on the settings for FREQ:SPAN and IFPath. You need to set these before making this query. Though the measurement name is specified in the query, you can only query the currently configured measurement. That is, if you have sent CONF:VECT, the query ADEM:SWE:ISR? will generate an error.

Mode	VSA

Remote Command	[:SENSe]:<meas>:SWEep:ISRate?
Example	VECT:SWE:ISR?
Preset	Depends on the licensed IF path
Notes	Query returns the complex sample rate in Hz for the current VXA Vector measurement setup conditions. If the measurement in the query is not the active measurement, error -230 is reported and no data is returned. This query is SCPI only, no Front Panel softkey.
Initial S/W Revision	A.04.00

Parameter Update Enable

When a measurement parameter is changed, the new value is used to update dependent parameters and measurement results. This update process is usually done after every parameter change. This command allows you to postpone this update until after a group of parameters changes, and then allow the update to run once afterwards. This can help decrease setup time for SCPI-controlled measurements.

For example, if your program is setting up a complex LTE measurement, it could save some time by first sending EVM:PUPD:ENAB OFF, then sending the whole group of measurement setup commands. (Note that if you try to immediately read back a parameter value after setting it, you are not guaranteed to get back true value that will be used in the measurement because dependencies have not been resolved.) When you are done with the setup, send EVM:PUPD:ENAB:ON. After this, you can read back the parameters' actual values. Starting or continuing a measurement (INITiate:RESTart or INITiate:IMMediate) will automatically set PUPD:ENAB to ON.

This command should be used carefully. It should not be used before a preset (CONF:<meas>). If you Parameter Update Enable off, you should make the necessary changes and turn it back on before doing any queries, because no parameter limiting is done nor are any dependencies between parameters resolved while Parameter Update Enable is off.

Key Path	**SCPI only**
Mode	VSA, LTE, LTETDD, IDEN
Measurement	<meas>:=VECTor|ADEMod|DDEMod|W11A|W11B|EVM|IPOWer|IDEMod|MOTotalk
Remote Command	`[:SENSe]:<meas>:PUPDate:ENABle OFF|ON|0|1` `[:SENSe]:<meas>:PUPDate:ENABle?`
Example	EVM:PUPD:ENAB OFF
Notes	INIT:IMM or INIT:REST will set this to ON
Preset	1
State Saved	No
Initial S/W Revision	A.03.00