Keysight Wireless Test Set

E7760A Wideband Transceiver

KEYSIGHT TECHNOLOGIES

User's Guide

Notices

Trademark Acknowledgments

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Warranty

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, browse to one of the following URLs, according to the name of your product:

http://www.keysight.com/find/e7760a

To receive the latest updates by email, subscribe to Keysight Email Updates at the following URL:

http://www.keysight.com/find/MyKeysight

Information on preventing instrument damage can be found at:

www.keysight.com/find/PreventingInstrumentRepair

For online assistance:

www.keysight.com/find/assist

To contact Keysight Technologies:

www.keysight.com/find/contactus

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

Table of Contents

1 Getting Started

The following topics can be found in this section:

Warning Statements and Symbols

Caution and Warning notices are used in this document are described below.

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING denotes a hazard. It calls attention to an operating procedure, practice or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Symbols used on the exterior of the test set are described below.

This symbol is used to indicate power ON (green LED).

This symbol is used to indicate power STANDBY mode (yellow LED).

This symbol indicates the input power required is AC.

The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to instructions in the documentation.

This symbol indicates separate collection for electrical and electronic equipment mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive 2002/96/EC).

Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Five years is the expected useful life of the product.

This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.

To return unwanted products, contact your local Keysight office.

Input/Output Cables

Connecting the mmWave Ports to the M1650A mmWave Transceiver requires a special cable which is supplied with the M1650A. Other types of cables should not be connected to the mmWave Ports.

For the IFIO ports, standard commercially available RF cables may be used.

Front Panel Features

Figure 1-1 E7760A Front Panel

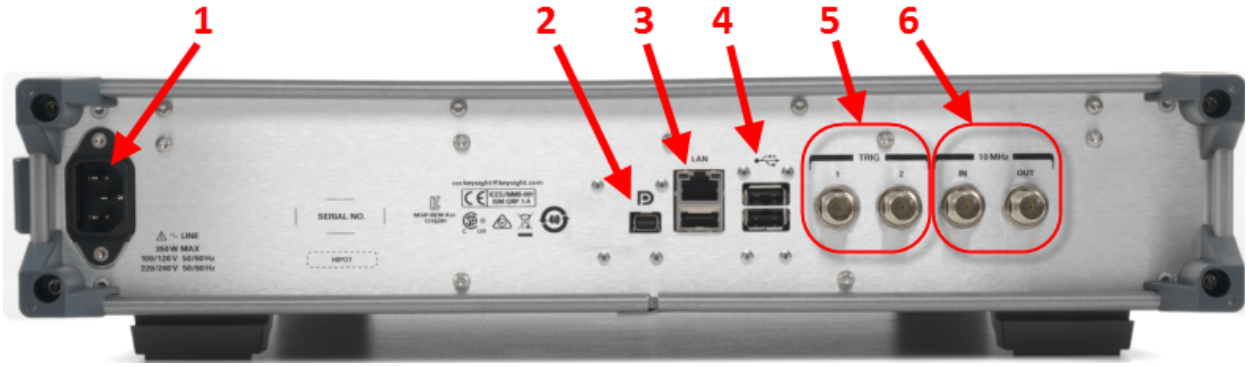
The features are described in the table below.

Number	Name	Description
1	USB Connectors	The instrument provides six USB 2.0 Ports, Type A.
2	mmW Port LEDs	The LEDs are used to indicate port usage for the mmWave Ports. The LED for a particular port will be blue if it is being used as an output port (providing a stimulus to the DUT) or green if it is being used as an input port (measuring a signal received from the DUT). The LED for an inactive port is not lit.
3	mmW Ports (A1, A2, A3, B1, B2, B3); also includes 36 VDC supply and control signals CAUTION	Type N connectors. These ports provide connection to M1650A mmWave Transceivers, by means of a special RF cable which is provided with the M1650A. Do not connect or disconnect the RF cable, at these ports or at the M1650A, while power is applied to the E7760A. Also note the label: 36 VDC Output Do not terminate or attenuate! For use with M16XX mmWave Transceiver only For port usage information, see “Port Rules (mmWave Ports)” on page 138.
4	Power On/Off	Power Standby/On switch and indicator LEDs. A green light indicates power on. A yellow light indicates standby mode (AC power is supplied to the E7760A but power is not on). The AC power cord can be used as the system disconnecting device. It disconnects the main circuits from the main supply.

Number	Name	Description
5	IF Port LEDS	The LEDs are used to indicate port usage for the IF Ports. The LED for a particular port will be blue if it is being used as an output port (providing a stimulus to the DUT) or green if it is being used as an input port (measuring a signal received from the DUT). The LED for an inactive port is not lit.
6	IF Ports (IFIO1, IFIO2) CAUTION	Type SMA connectors. See "Port Rules (IO Ports)" on page 140. Note the label: 

Rear Panel Features

Figure 1-2 E7760A Rear Panel



The features are described in the table below.

Number	Name	Description
1	Line Power	The AC Power Connection.
2	Monitor Port	This connector supports a connection to a monitor with a Mini DisplayPort.
3	LAN	An RJ45 connector for the TCP/IP Interface to a Local Area Network. This LAN port supports DHCP (dynamic assignment of IP address).
4	USB	3 USB 2.0 ports, Type A.
5	TRIG 1, TRIG 2	BNC connectors. TRIG 1 receives an external trigger input to the receiver. TRIG 2 furnishes an internal trigger output from the source.
6	10 MHz IN, 10 MHz OUT	The 10 MHz IN BNC connector accepts a timebase reference input from an external source. Restrictions: do not remove an input to this connector without first switching the test set to internal mode; also, do not switch the test set to external mode without first applying an input to the connector. The 10 MHz OUT BNC provides a timebase reference output to external instruments.

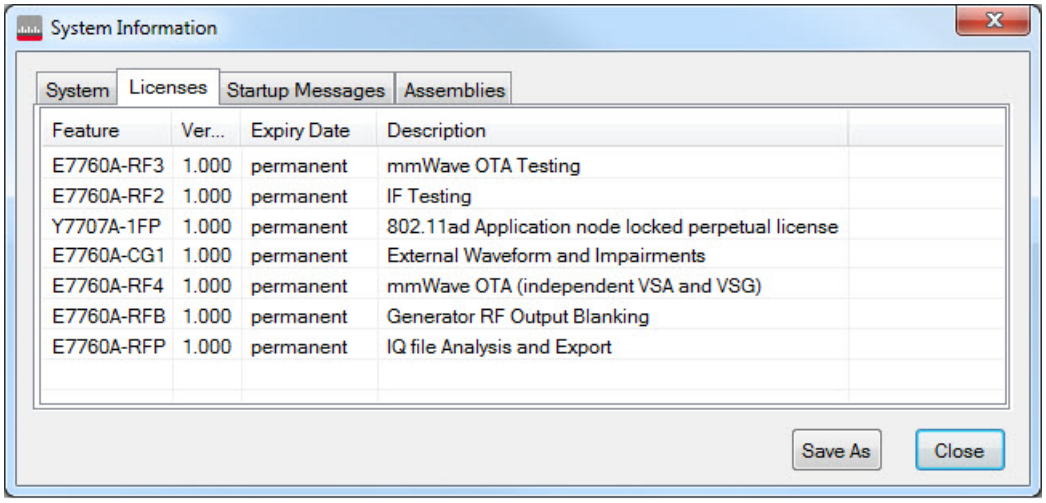
Licensing

Some features of the test set are licensed features, and are unavailable if the appropriate license is not installed:

- License E7760A-RF2 is required to operate the IFIO ports.
- License E7760A-RF3 is required to operate the mmWave ports (this license only supports operation with the same setting for input and output frequencies).
- License E7760A-RF4 is required to operate the mmWave ports with independent settings for input and output frequencies.
- License E7760A-RFP is required for IQ File Analysis and Export.
- License E7760A-RFB is required for generator RF blanking.
- License E7760A-CG1 is requirement for External Waveform and Impairments.
- License Y7707A-1*xx* (1FY, 1FP, 1TY, or 1TP) is required to generate and measure 802.11ad signals.

The options and licenses installed on the test set are listed under: **System > System Information > Licenses**.

Figure 1-3 Licenses



NOTE

You may register or sign in with your profile at:
www.keysight.com/find/softwaremanager
in order to obtain any software updates and/or new licenses using your entitlement details.

Transportable Licenses

Transportable licenses are identifiable by the “T” included in their license numbers (for example, Y7077A-1TP or Y7077A-1TY. This type of license enables you to move the license from one host instrument or PC to another, without the need to contact Keysight. Follow the steps above to install the transportable license for the first time.

To transport a license after that installation, run Keysight License Manager on the host that currently has the license, and transport the license. (Select **Help > Keysight License Manager Help** and search for “transport” to find detailed instructions.)

NOTE

Transportable licenses for the E7760A allow you to transport licenses up to 30 times within the previous 10 days.

You can also save a transportable license to Keysight Software Manager (KSM) for later assignment to a host. To do so, review the Transporting Licenses section (found as described above) in the Keysight License Manager Help. When you are asked to choose a destination for the license, select **Save the license to Keysight Software Manager**.

When you are ready to assign the license to a host, come back to KSM and look for the action bubble entitled **You can request new licenses**. Click the bubble and follow the instructions given.

Other related topics for managing your software and licenses can be found by reviewing the Keysight License Manager Help available from the **Help** drop-down menu of the KSM software.

Instrument Maintenance

Preventive Maintenance

This product is not user serviceable and must be returned to Keysight for repair or maintenance.

Cleaning the instrument

WARNING To prevent electrical shock, disconnect the test set from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

Cleaning the connectors

WARNING Cleaning connectors with alcohol shall only be done with the instrument power cord removed, and in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

Battery Information

The test set uses a lithium battery located on the CPU board. This is not an operator replaceable part. See “Returning a test set for Service” on page 28. Replaceable parts must be approved or supplied by Keysight Technologies.

You can order the service documentation for the instrument through your Keysight Sales and Service office.

WARNING Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to the manufacturer’s instructions.

Do not throw batteries away but collect as small chemical waste.

DO NOT THROW BATTERIES AWAY BUT COLLECT AS SMALL CHEMICAL WASTE.

Returning a test set for Service

Calling Keysight Technologies

Keysight Technologies has offices around the world to provide you with complete support for your test set. To obtain servicing information or to order replacement parts, contact the nearest Keysight Technologies office listed in the following table. In any correspondence or telephone conversations, refer to your test set by its product number, full serial number, and software revision.

Press **System**, **Show, System**, and the product number, serial number, and software revision information is displayed on your test set screen. A serial number label is also attached to the rear panel of the test set.

Locations for Keysight Technologies

Americas	Canada (877) 894 4414	Brazil 55 11 3351 7010	Mexico 001 800 254 2440
	United States (800) 829 4444		
Asia & Pacific	Australia 1 800 629 485	China 800 810 0189	Hong Kong 800 938 693
	India 1 800 112 929	Japan 0120 (421) 345	Korea 080 769 0800
	Malaysia 1 800 888 848	Singapore 1 800 375 8100	Taiwan 0800 047 866
	Other Asia-Pacific countries: (65) 6375 8100		
Europe & Middle East	Austria 0800 001122	Belgium 0800 58580	Finland 0800 523252
	France 0805 980333	Germany 0800 6270999	Ireland 1800 832700
	Israel 1 809 343051	Italy 800 599100	Luxembourg +32 800 58580
	Netherlands 0800 0233200	Russia 8800 5009286	Spain 0800 000154
	Sweden 0200 882255	Switzerland 0800 805353 Opt. 1 (DE), Opt. 2 (FR), Opt. 3 (IT)	United Kingdom 0800 0260637

Online assistance: http://www.keysight.com/find/assist

Contact us: http://www.keysight.com/find/contactus

Read the Warranty

The warranty for your test set is in the front of your Specifications Guide. Please read it and become familiar with its terms.

If your test set is covered by a separate maintenance agreement, please be familiar with its terms.

Service Options

Keysight Technologies offers several optional maintenance plans to service your test set after the warranty has expired. Call your Keysight Technologies office for full details.

Packaging the Test Set

Use original packaging or comparable materials. It is best to pack the unit in the original factory packaging materials if they are available.

CAUTION Test set damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the test set or prevent it from shifting in the carton. They cause test set damage by generating static electricity and by lodging in the test set louvers, blocking airflow.

You can repackage the test set with commercially available materials, as follows:

Step	Notes
1. Wrap the test set in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.	
2. Use a strong shipping container.	The carton must be both large enough and strong enough to accommodate the test set. A double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength is adequate. Allow at least 3 to 4 inches on all sides of the test set for packing material.
3. Surround the equipment with three to four inches of packing material and prevent the equipment from moving in the carton.	If packing foam is not available, the best alternative is plastic bubble-pak. This material looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink-colored bubble which reduces static electricity. Wrapping the equipment several times in this material should both protect the equipment and prevent it from moving in the carton.
4. Seal the shipping container securely with strong nylon adhesive tape.	
5. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to assure careful handling.	
6. Retain copies of all shipping papers.	

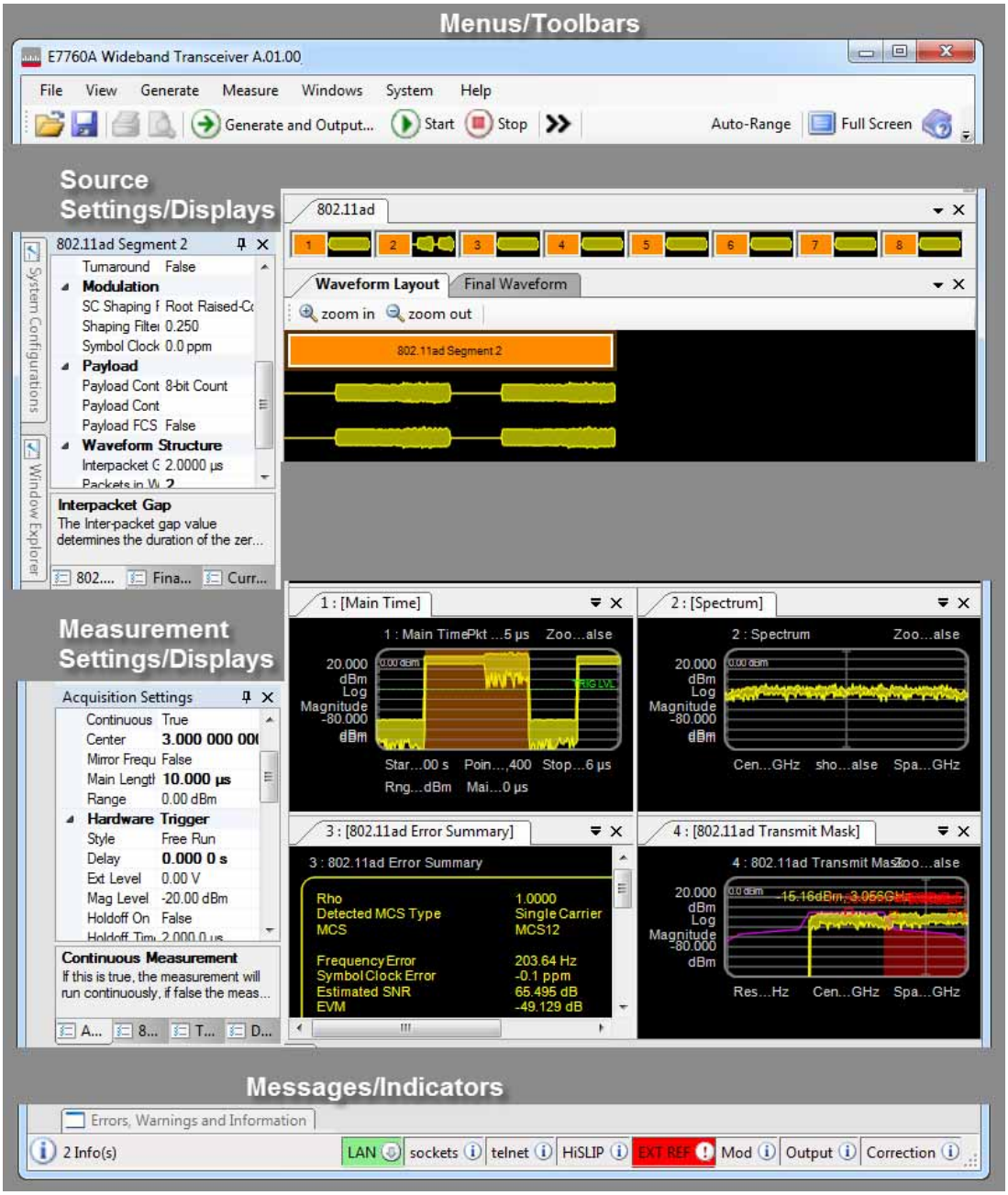
2 Graphical User Interface

The following topics can be found in this section:

Elements of the Interface

The display screen is divided into the sections illustrated below.

Figure 2-1 Main Sections of the Display

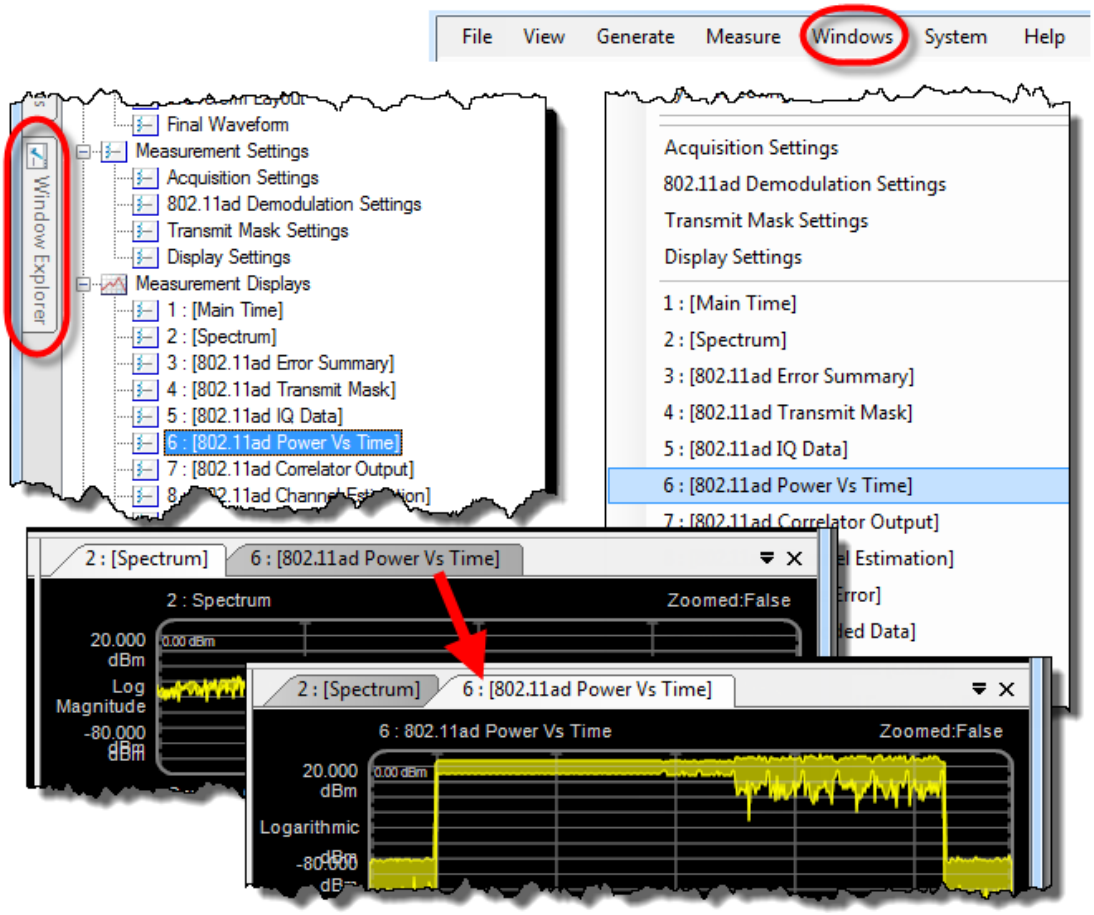


Source and measurement functions are controlled and displayed primarily in a set of separate, detachable windows, with source-related functions concentrated in the upper half of the display and measurement-related functions in the lower half. In addition, there is a menu bar and a toolbar at the top of the display, and status indicators at the bottom.

Accessing, Docking, and Un-docking Windows

If a window is not currently visible in the display, it can be accessed by selecting it from the **Window Explorer** pane or from the **Windows** menu. Also, if the case of a tabbed display within a window, clicking on the tab at the top of the window area will make the currently hidden tab visible.

Figure 2-2 Accessing windows

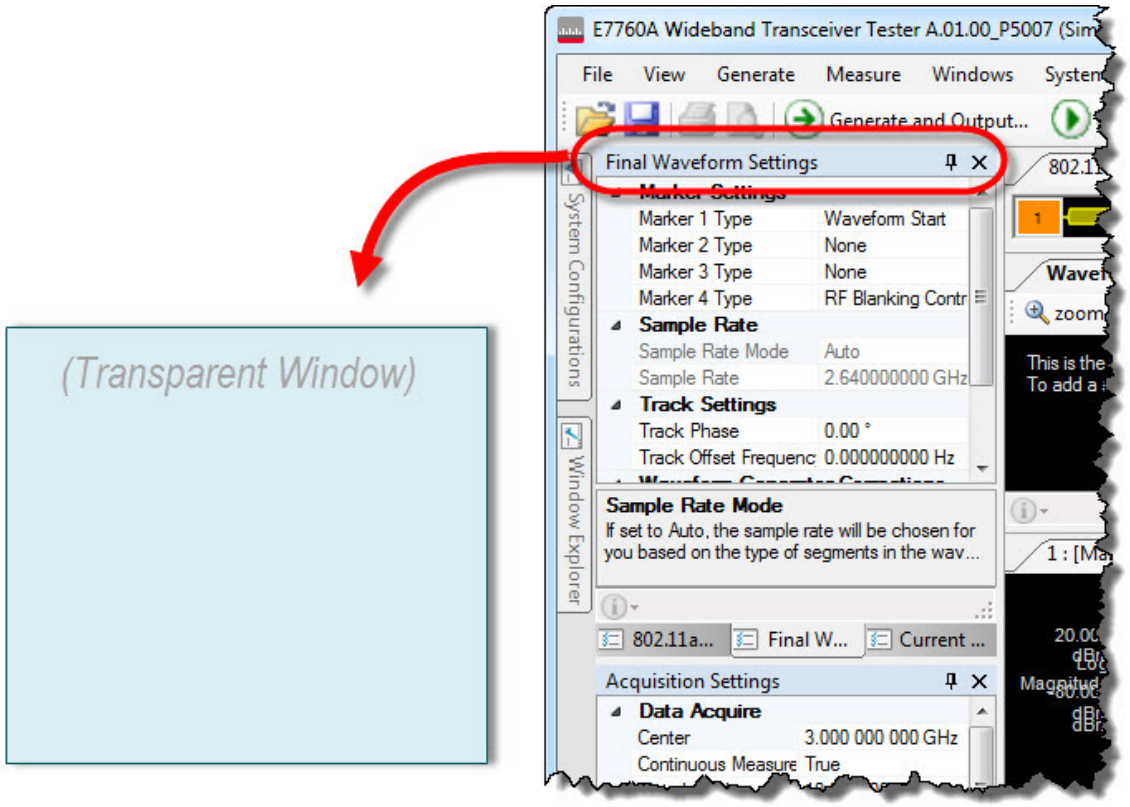


NOTE

The twelve numbered items at the bottom of the Windows menu are the twelve measurement display windows. The names of the measurements shown in this menu are those currently displayed in the windows, and do not represent all of the possibilities. Right-clicking on the top of a given measurement display window brings up a complete list of measurements which can be displayed in it.

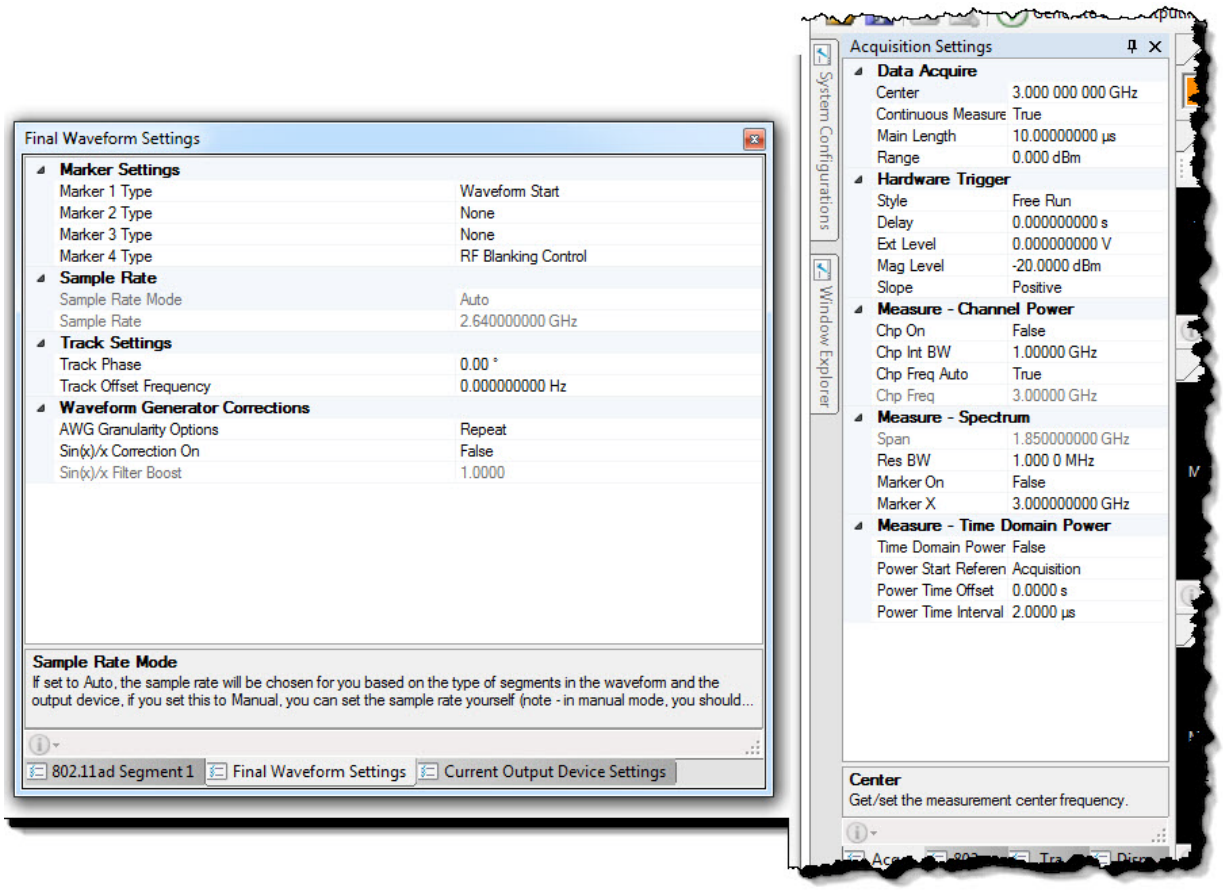
A window can be un-docked from the main display window by clicking on its title bar at the top, and dragging it around the screen (while it is being moved, it is represented by a light-blue transparent rectangle)

Figure 2-3 Un-docking a window (click top of frame and drag)



The un-docked window can be positioned and resized for easier viewing.

Figure 2-4 Un-docked Window



To return the un-docked window to the main display, position it at a point on the display and use the five-point selector to insert the window at that point (the center button) or adjacent to it (the directional buttons).

Figure 2-5 Docking the window (drag back to main window)

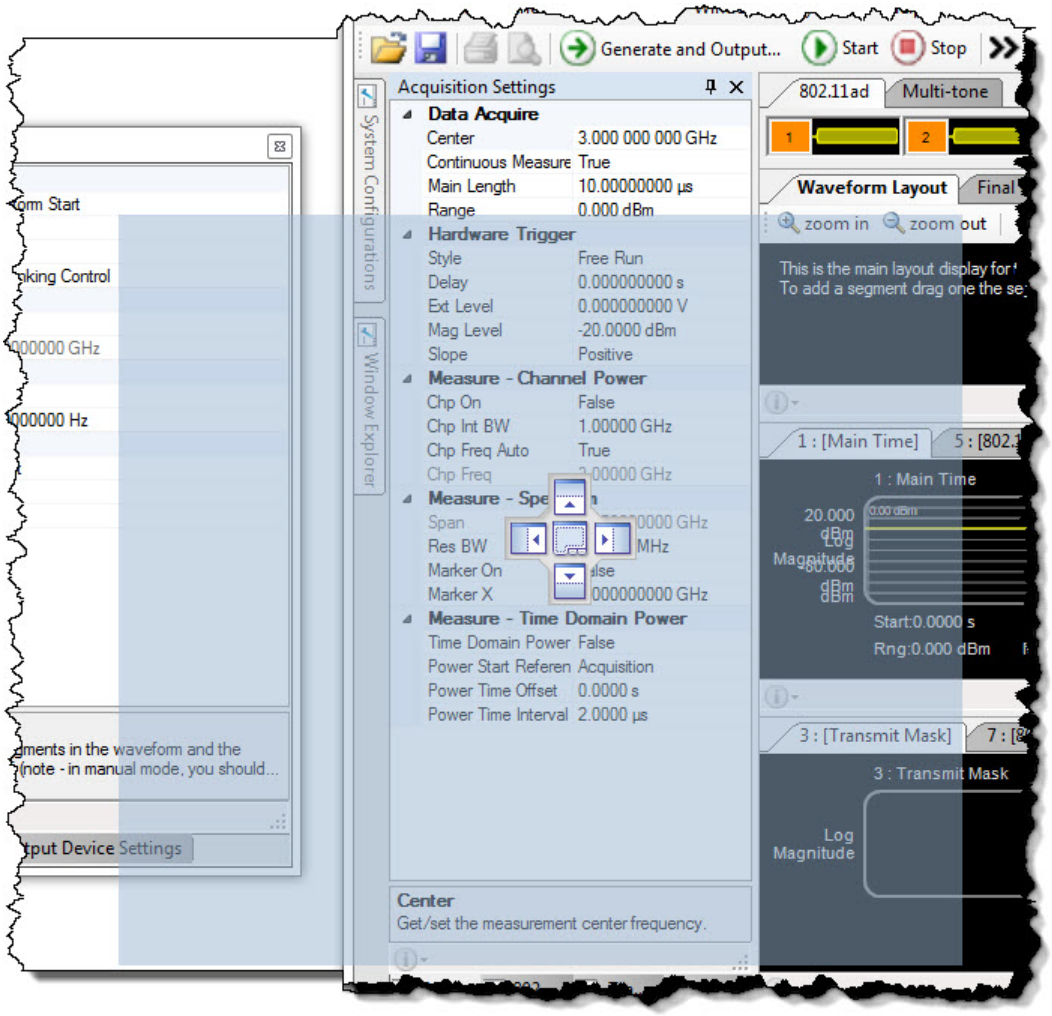
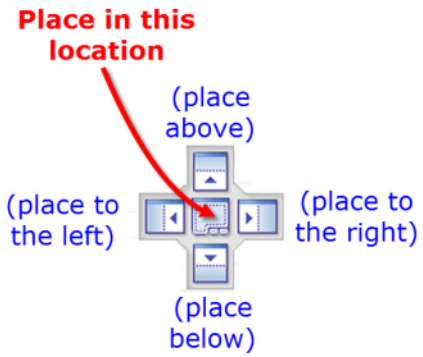


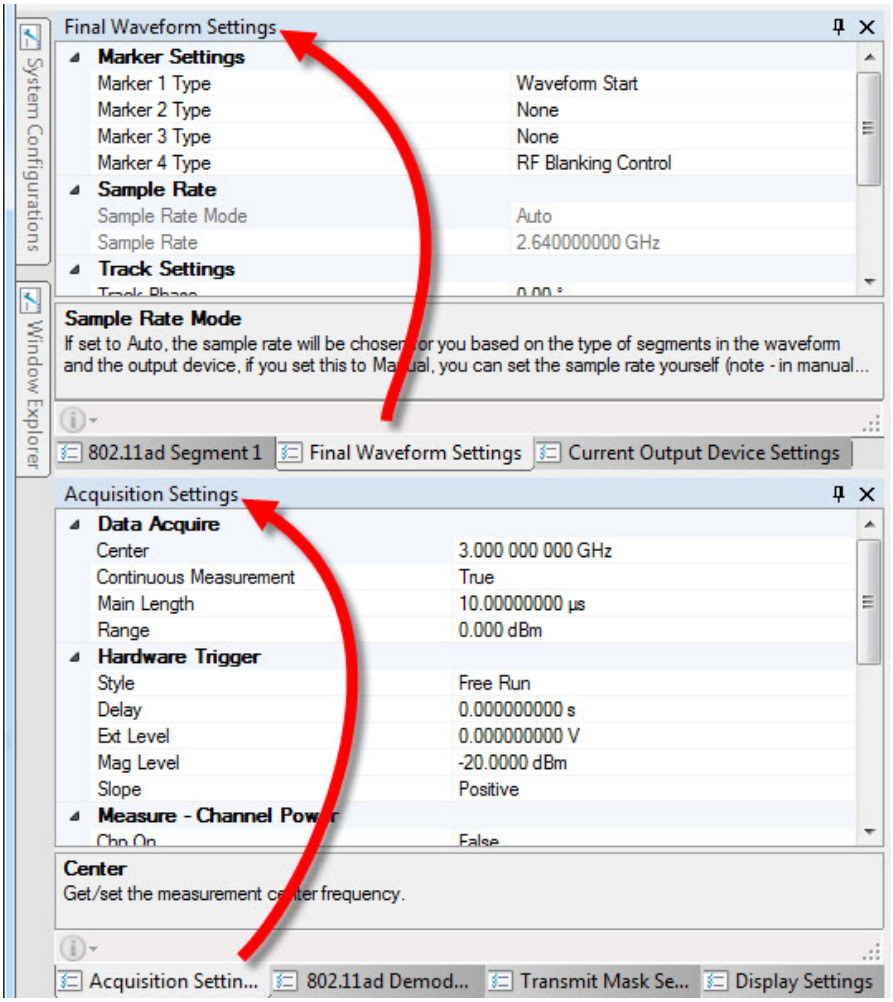
Figure 2-6 Interpreting the docking indicator (click one of the five symbols)



Using Settings Windows

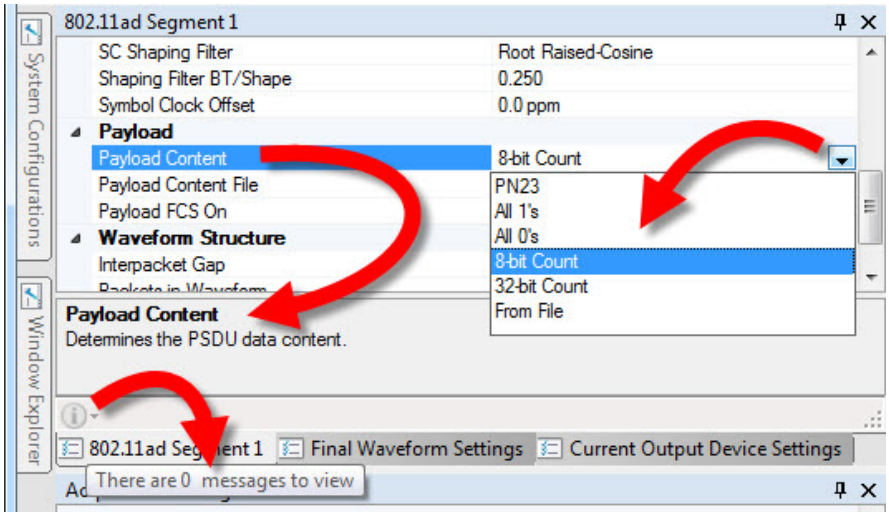
The various settings windows can be viewed by clicking the tabs which show their names.

Figure 2-7 Window-selection tabs



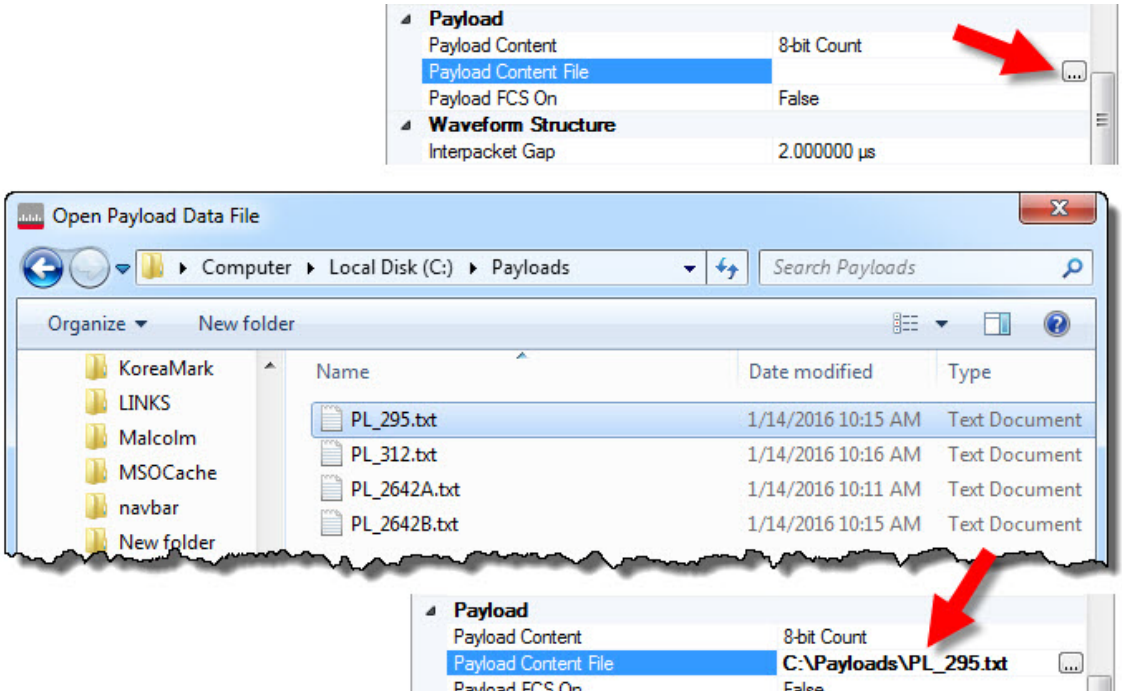
When a setting is selected, information about it is displayed at the bottom of the window. Also, if the current setting is one of a set of selections, a drop-down menu of the available choices can be opened by clicking on the down-arrow icon on the right. Where an information icon appears, as at the bottom of the window shown below, clicking on the icon will make the information (typically an error message) visible.

Figure 2-8 Displaying information about settings



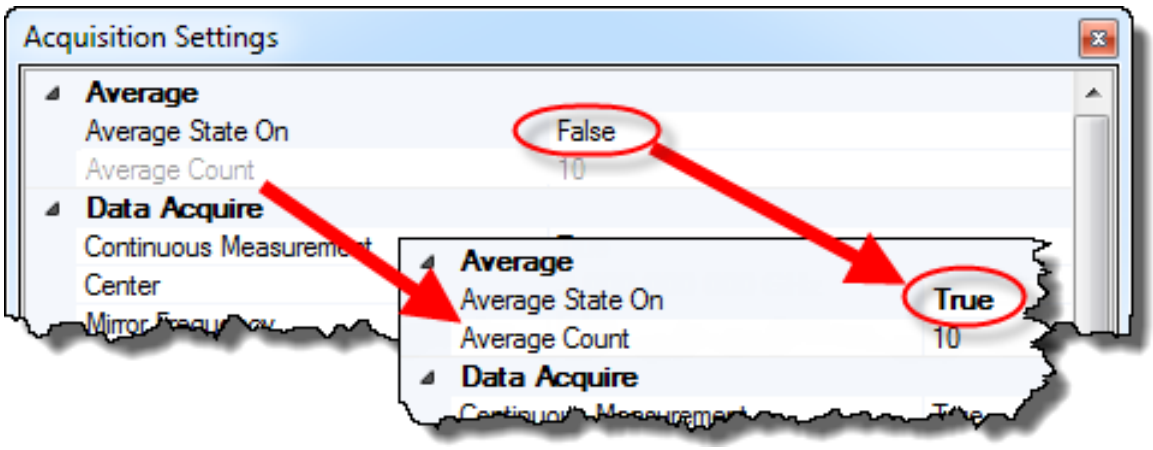
In some cases, an ellipsis button is shown at the right of the setting; clicking on this button opens a file-selection window.

Figure 2-9 Using the ellipsis button to specify a file



Some settings cannot be made until a related setting is in a particular state. For example, if the average count for an acquisition cannot be set unless averaging is enabled for the acquisition; the **Average Count** setting is therefore grayed out until **Average State On** is set to True. If a setting is grayed out or will not accept changes, this indicates that some other setting needs to be made first.

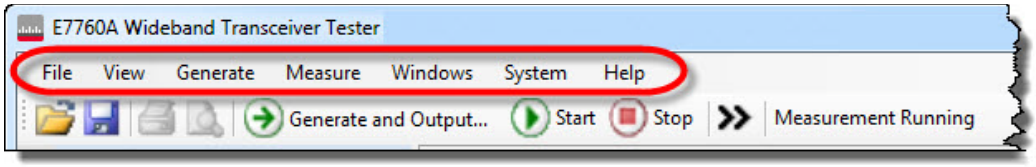
Figure 2-10 Settings dependent on other settings



Menus

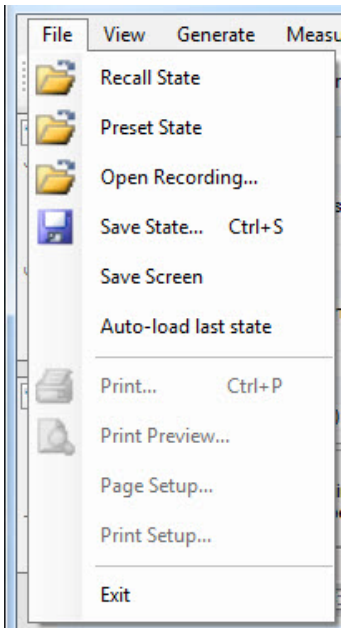
Seven menus can be opened by clicking on there names at the top of the application window.

Figure 2-11 Menus



File menu

Figure 2-12 File menu



The File menu selections are described below.

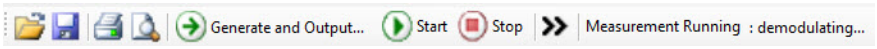
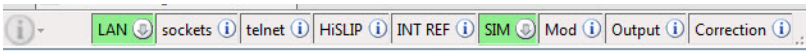
Selection	Description
Recall State	Opens a file-selection window, so that you can open a `<filename>.state` file in which a preferred configuration of the test application has been stored. See also: Recall Layout, under "System Configurations" on page 106.
Preset State	Reloads the preset (default) state for the test application. See also: Recall Layout, under "System Configurations" on page 106.

Selection	Description
Open Recording...	Opens a file-selection window, so that you can open a `<filename>.csv` file in which recorded data has been stored. (Data can be recorded by right-clicking on the displayed data in the Main Time result window, and selecting Save IQ Data As on the pop-up menu which appears.) This feature requires license E7760A-RFP.
Save State	Opens a file-save window, so that you can save the current configuration of the test application to a `<filename>.state` file.
Save Screen	Opens a file-save window, so that you can save a screen capture image in the specified file location in the .png file format.
Auto-load last state	Check or uncheck this selection. If this is selected, the test application will automatically start in the same state it was in when last closed.
Print	Print the contents of whichever measurement display window was last selected for viewing. (If no display window has been selected, print functions are not enabled and the icon is grayed out.)
Print Preview...	Open a preview window to verify which measurement display is currently selected for the Print function. (If no display window has been selected, print functions are not enabled and the icon is grayed out.)
Page Setup...	Open a page setup window for printing, to select settings such as page size and orientation. (If no display window has been selected, print functions are not enabled and the icon is grayed out.)
Print Setup...	Open a printer setup window for printing, to select the printer and its options. (If no display window has been selected, print functions are not enabled and the icon is grayed out.)
Exit	Close down the test application entirely.

View menu

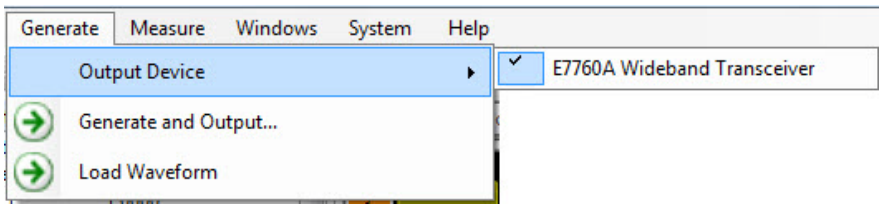
Figure 2-13 View menu

The View menu selections are described below.

Selection	Description
Tool Bar	Toggle to show or hide the Tool Bar at the top of the display. 
Status Bar	Toggle to show or hide the Status Bar at the bottom of the display. 

Generate menu

Figure 2-14 Generate menu

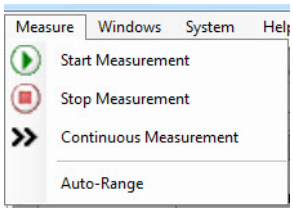


The Generate menu selections are described below.

Selection	Description
Output Device	E7760A Wideband Transceiver is currently the only available output device.
Generate and Output...	Generate the waveform and furnish the signal to the specified output port.
Load Waveform	Loads a user-supplied waveform ARB memory and begins generator playback. **Generate and Output** must not be invoked as it will supplant the user-supplied waveform with a waveform based on the **Final Waveform** settings. The user-supplied waveform must be a .txt file. The required format for the file is described under ":OUTPut:DEVice:ARB:LOAD command" on page 216. See SCPI command `:OUTPut:DEVice:ARB:LOAD` This feature requires license E7760A-CG1. See also: "Generator Waveform Optimization" on page 72

Measure menu

Figure 2-15 Measure menu

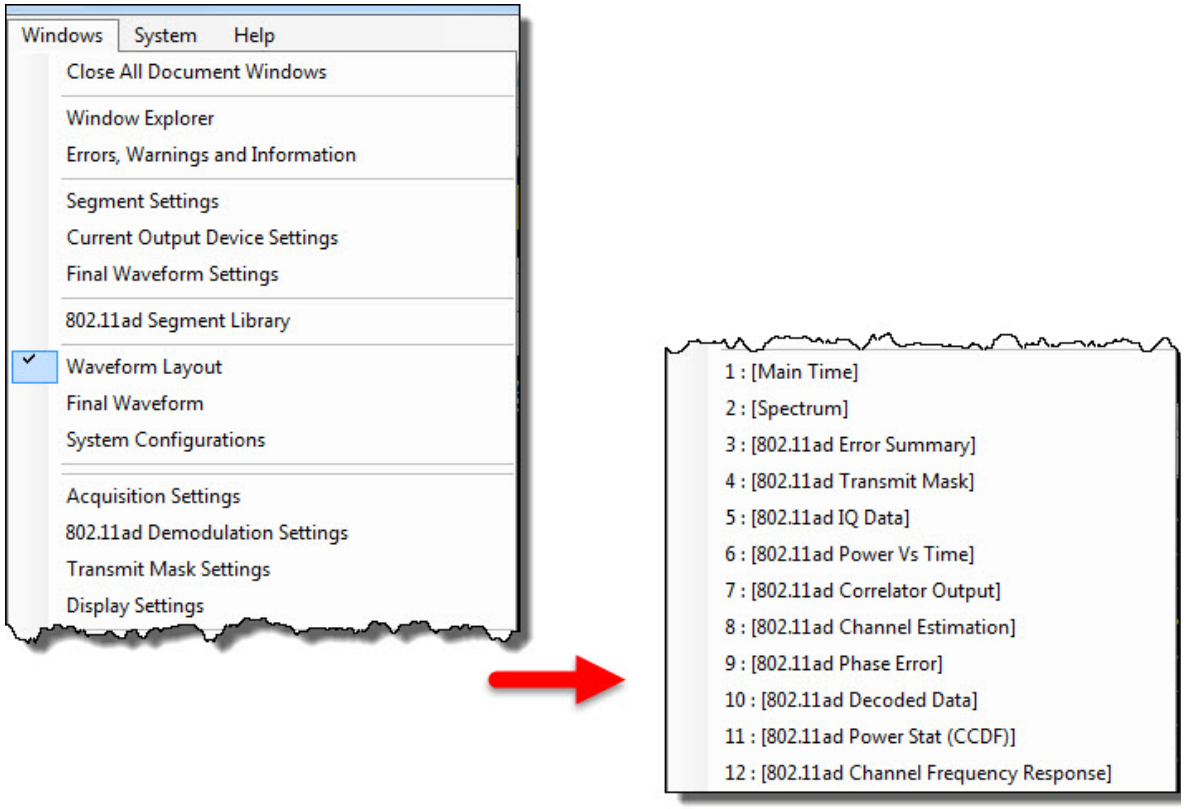


The Measure menu selections are described below.

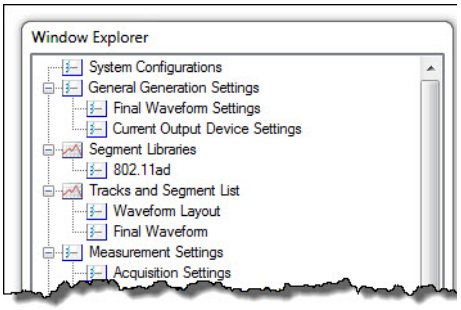
Selection	Description
Start Measurement	Click to start the measurement.
Stop Measurement	Click to stop the measurement.
Continuous Measurement / Single Measurement	Click to toggle between continuous measurement mode and single measurement mode.
Auto-Range	Click to auto-range the channel of the measurement. When this is complete, the message "Auto-Ranging done" is displayed in toolbar (however, this may soon be over-written by a "Measurement Running" message, if the Continuous Measurement mode is selected).

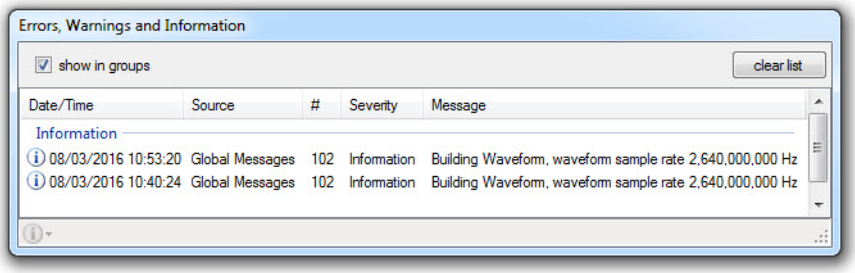
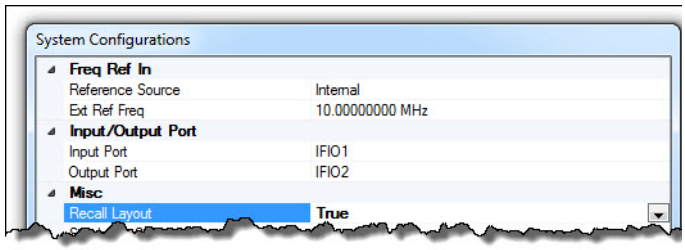
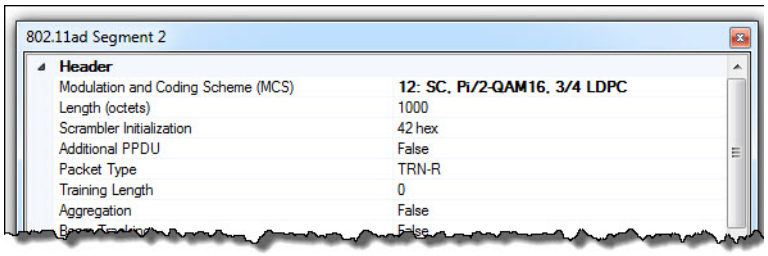
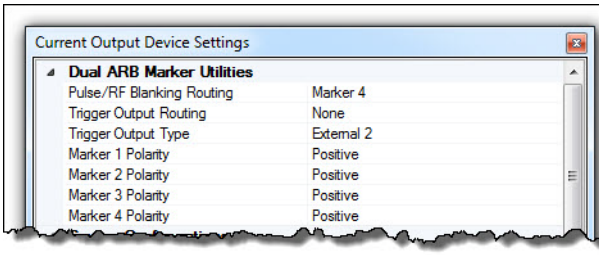
Windows menu

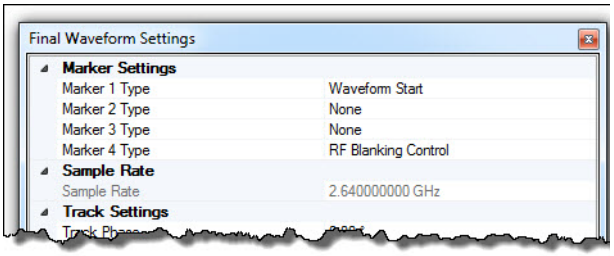
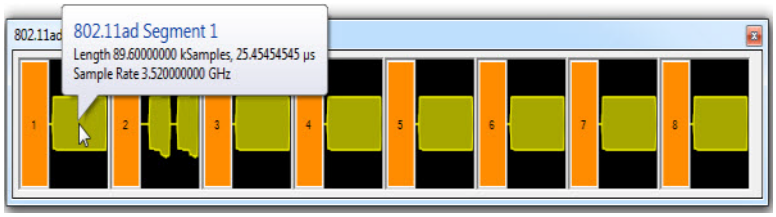
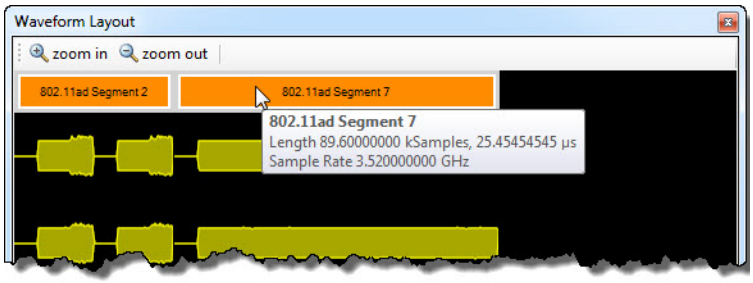
Figure 2-16 Windows menu

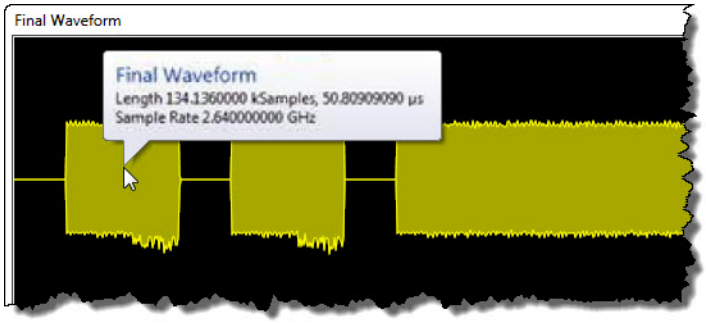
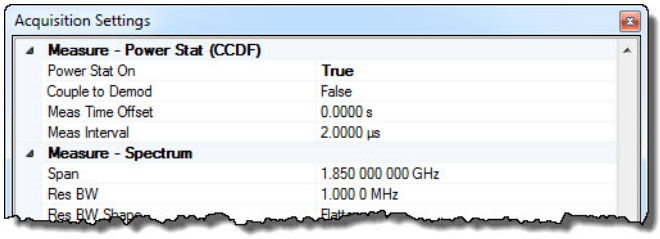
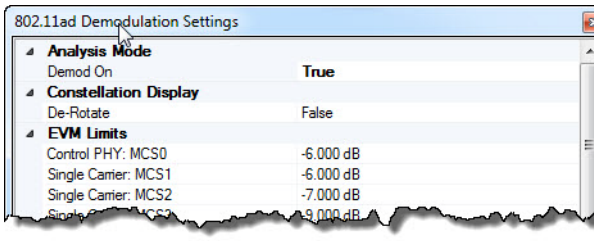
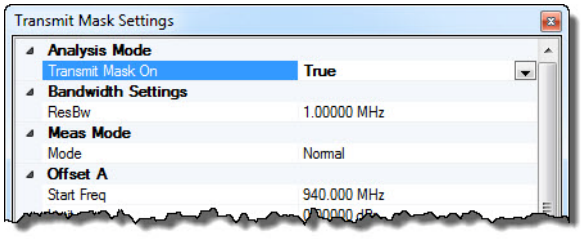


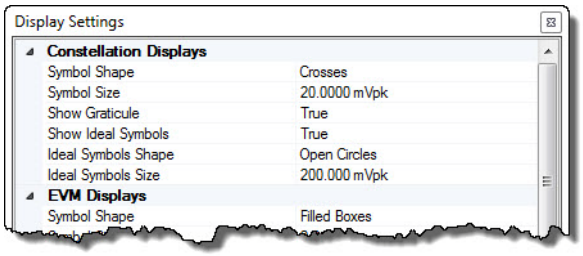
The Windows menu selections are described below.

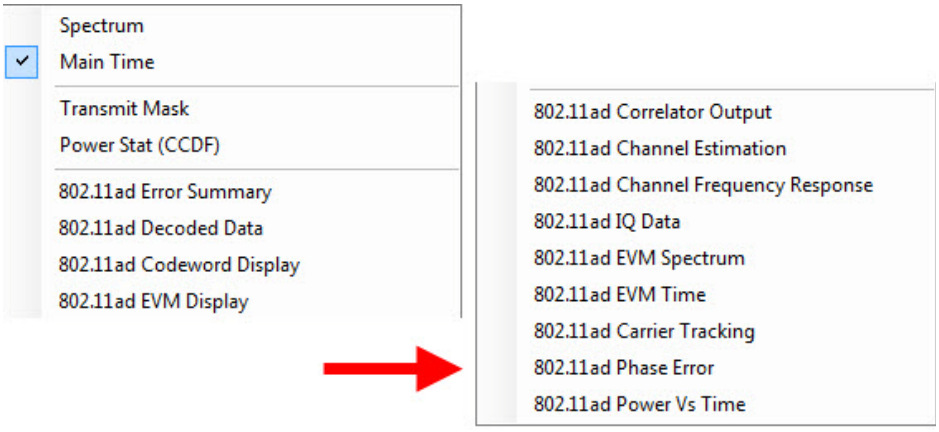
Selection	Description
Close All Document Windows	Close all the waveform windows and the measurement display windows. They can be re-opened (individually) by selecting them in the Window Explorer window.
Window Explorer	Click on the name of a window in this tree structure to open it. See "Windows Explorer" on page 108. 

Selection	Description
Errors, Warnings and Information	Open a window which displays operating information and notices of error conditions. See “Messages & status indicators” on page 109. 
System Configurations	Open a window which configures system settings (for example, port usage). See “System Configurations” on page 106. 
Segment Settings	Open a window which configures waveform segment settings (for example, the Modulation and Coding Scheme for the waveform). See “802.11ad Segment Settings” on page 58. 
Current Output Device Settings	Open a window which configures source settings (for example, the output frequency and level). See “Current Output Device Settings” on page 67. 

Selection	Description
Final Waveform Settings	Open a window which configures settings for the overall waveform, including all segments (for example, marker settings). See "Final Waveform Settings" on page 63. 
802.11ad Segment Library	Open a window offering a selection of 802.11ad waveform segments. To see details about a segment, hover the mouse over it. To add a segment, click on it and drag it into the Waveform Layout window. (Do not drag over the Final Waveform tab, as this opens the wrong window.) See "802.11ad Segment Library" on page 69. 
Waveform Layout	Open a window into which waveform segments are dragged in order to assemble the final waveform. To see details about a segment, hover the mouse over it. See "Waveform Layout" on page 70. 

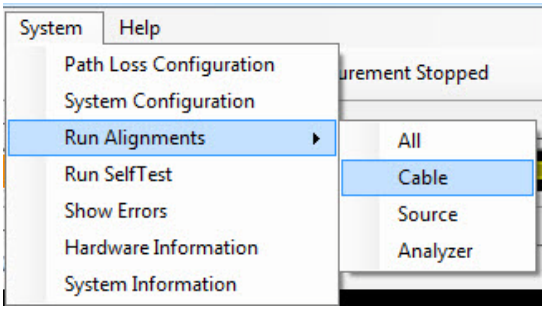
Selection	Description
Final Waveform	Open a window showing the assembled final waveform. To see details about the final waveform, hover the mouse over it. See "Waveform Layout" on page 70. 
Acquisition Settings	Open a window which configures settings for the acquisition (for example, enabling or disabling particular measurements). See "Acquisition Settings" on page 74. 
802.11ad Demodulation Settings	Open a window which configures settings for demodulation (for example, enabling or disabling demodulation analysis). See "802.11ad Demodulation Settings" on page 80. 
Transmit Mask Settings	Open a window which configures settings for Transmit Mask (for example, enabling or disabling transmit mask analysis. See "Transmit Mask Settings" on page 84. 

Selection	Description
Display Settings	Open a window which configures settings for data display (for example, symbol shapes and sizes). See “Display Settings” on page 86. 

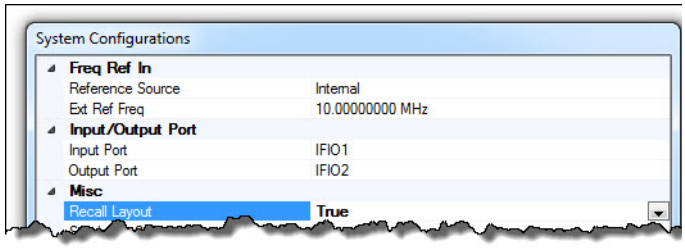
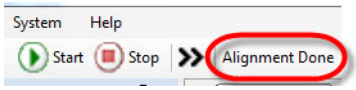
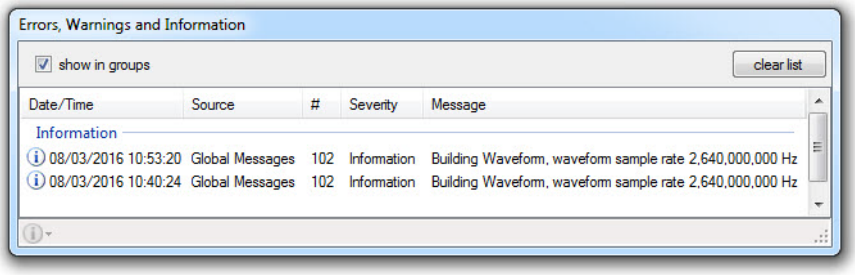
Selection	Description
Numbered Windows	The bottom 12 items in the menu represent the twelve measurement result windows which can be displayed at any one time. The name of the measurement currently assigned to each window is shown following the number. The numbers indicate the window positions on the screen; the numbering scheme is illustrated below.  No measurement is permanently linked to a particular numbered window. To select a different measurement for a given window, right-click the tab at the top of the window, and select a measurement from the pop-up menu that appears (not all of these selections will appear in the Window menu, which only lists those measurements currently selected for the twelve numbered windows). 

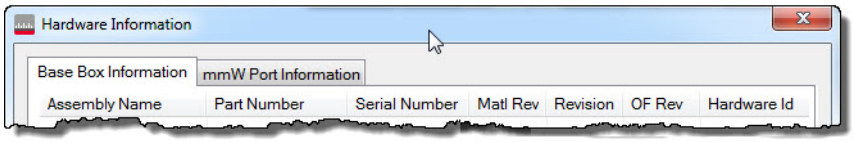
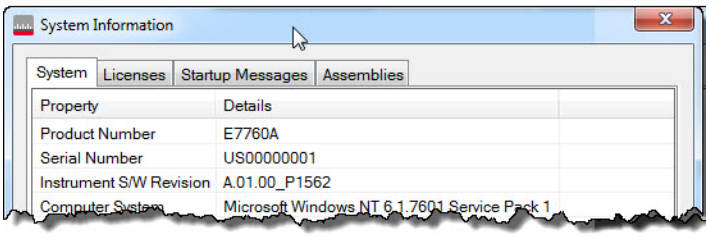
System menu

Figure 2-17 System menu



The System menu selections are described below.

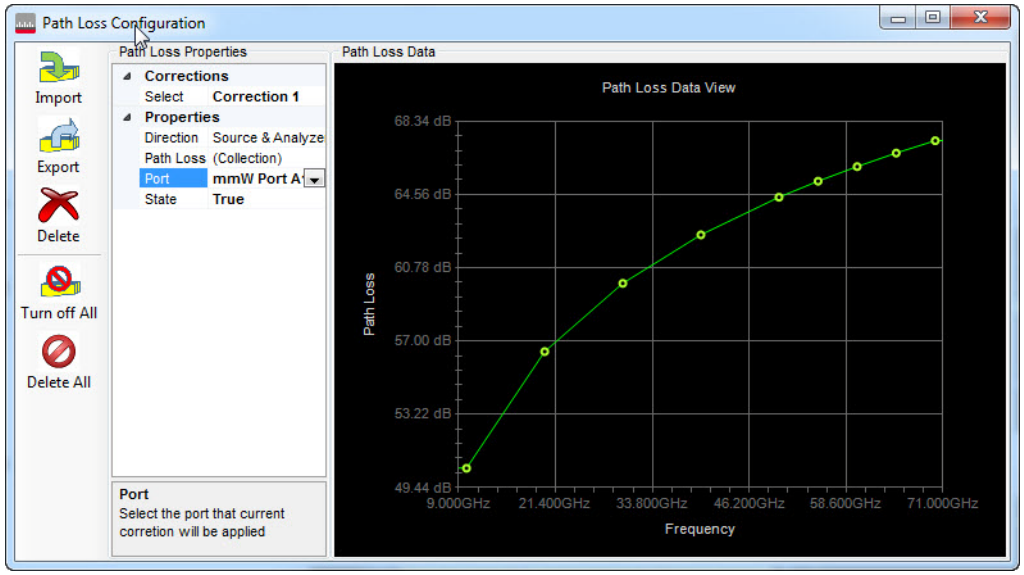
Selection	Description
Path Loss Configuration	See "Path Loss Configuration" on page 53.
System Configuration	Open a window which configures system settings (for example, port usage). See "System Configurations" on page 106. 
Run Alignments	Select All, Cable, Source, or Analyzer ("All" runs both Source and Analyzer alignments). "Alignment Done" is displayed when the process completes.  See SCPI commands `:CALibration`
Show Errors	Open a window which displays operating information and notices of error conditions. See "Messages & status indicators" on page 109. 

Selection	Description
Hardware Information	Open a window which displays information about installed hardware. The Save As button can be used to save the displayed information to a text file. 
System Information	Open a window which displays information about the system (serial number, licenses, and so on.) The Save As button can be used to save the displayed information to a text file. 

Path Loss Configuration

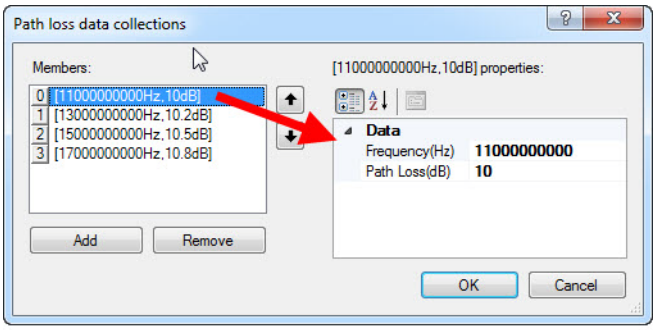
This interactive window makes it possible to import, edit, and export path loss corrections.

Figure 2-18 Path Loss Configuration window



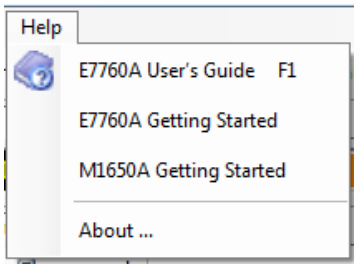
The Path Loss Configuration menu selections are described below.

Selection	Description
Icons (on left)	Import: open and import a correction file (.csv format). Export: export and save a correction file (.csv format) Delete: delete the currently selected path loss correction data from memory. Turn off All: disable all corrections (turn the State to False for all). Delete All: delete the data for all path loss corrections from memory.
Corrections:	
Select	Drop down menu: select Correction *n* (1 to 8) Select one of eight possible corrections. See SCPI command `:MMEMory:LOAD:CORRection:CSET`

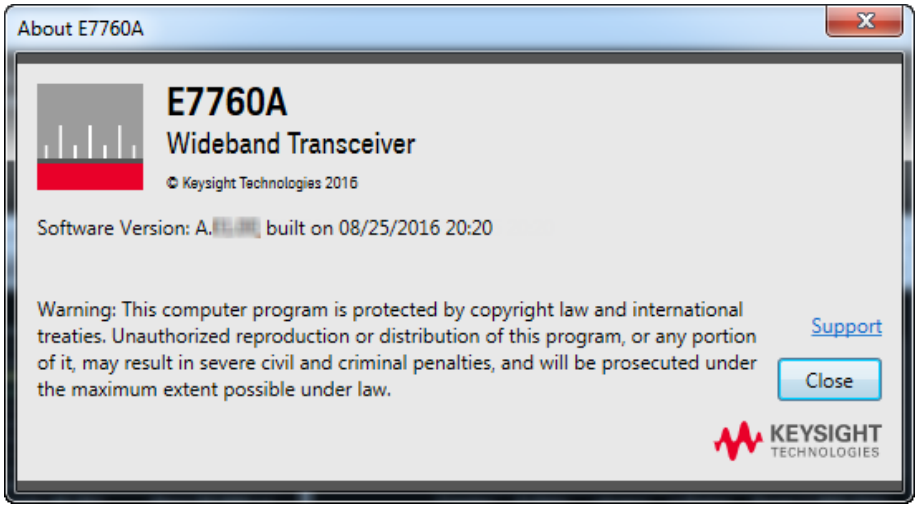
Selection	Description
Properties:	
Direction	Drop down menu: select Source & Analyzer | Source | Analyzer. Apply the specified correction set to the outgoing signal (source), incoming signal (analyzer), or both. See SCPI command `:SENSe:CORRection:CSET:DIRection`
Path Loss (Collection)	Click the ellipsis button to open a window which can be used to add, change, or delete data points. Whichever point is highlighted in the left pane can be edited in the right pane.  Use the Add and Remove buttons to add a new data point or delete an existing one. Click OK to apply the changes, or Cancel to discard them. See SCPI commands `:SENSe:CORRection` (various)
Port	Select the name of the port that is relevant to the correction from the drop down menu. See SCPI command `:SENSe:CORRection:CSET:PORT`
State	Drop down menu: select True or False. (False is the default selection.) Enable or disable the currently selected correction table. SCPI command `:SENSe:CORRection:CSET:[STATe]`

Help menu

Figure 2-19 Help menu



The Help menu selections are described below.

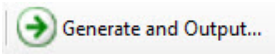
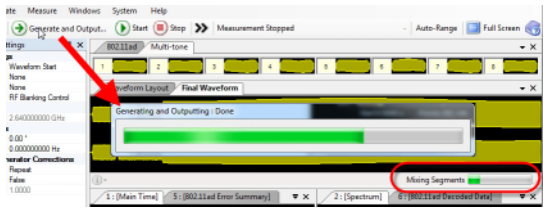
Selection	Description
E7760A User's Guide...	Opens the E7760A User's Guide, which includes detailed information about the user interface features and their equivalent SCPI commands.
E7760A Getting Started	Opens the E7760A Getting Started Guide, which includes safety notices and information about installing and updating software.
M1650A Getting Started	Opens the M1650A Getting Started Guide, which includes safety and usage information about the M1650A mmWave Transceiver.
About...	Opens a window which displays information about the E7760A, including its currently installed firmware version. 

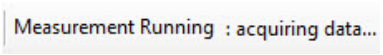
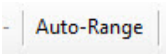
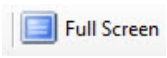
Toolbar

A toolbar is available just below the menus at the top of the displays.

Figure 2-20 Toolbar

The toolbar icons are described below.

Selection	Description
	Opens a file-selection window, so that you can open a `<filename>.state` file in which a preferred configuration of the test application has been stored. See also: Recall Layout, under "System Configurations" on page 106.
	Opens a file-save window, so that you can save the current configuration of the test application to a `<filename>.state` file.
	Print the contents of whichever measurement display window was last selected for viewing. (If no display window has been selected, print functions are not enabled and the icon is grayed out.)
	Open a preview window to verify which measurement display is currently selected for the Print function. (If no display window has been selected, print functions are not enabled and the icon is grayed out.)
	Create the waveform and download it to the E7760A's internal source. A progress bar appears while the process is being completed. 
	Start the measurement.
	Stop the measurement.

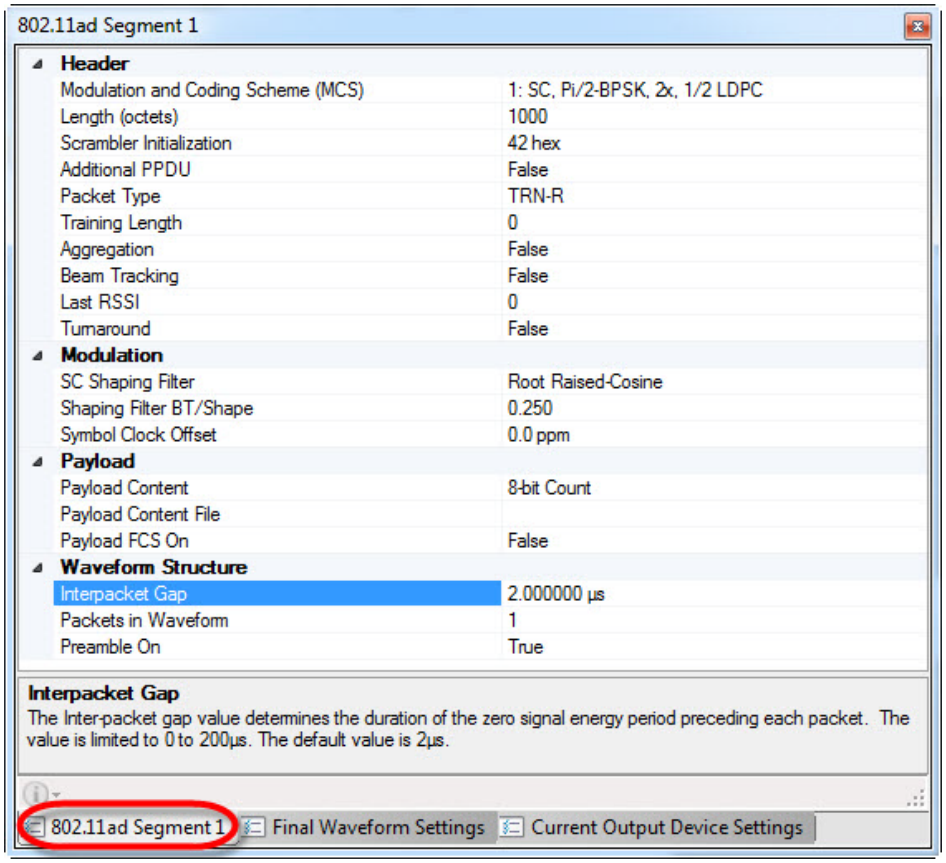
Selection	Description
	The double arrow indicates that the E7760A is in continuous measurement mode; the single arrow indicates that the measurement will stop after one cycle. Clicking on the icon toggles the setting between these two states.
	This area of the display provides status messages, usually pertaining to a measurement in progress.
	Click **Auto-Range** to optimize the range of displayed measurement data for the type of signal being received.
	Click **Full Screen** to activate and inactivate full-screen display mode for the E7760A Application window.
	Opens the E7760A User's Guide, which includes detailed information about the user interface features and their equivalent SCPI commands.

Transmit Functions

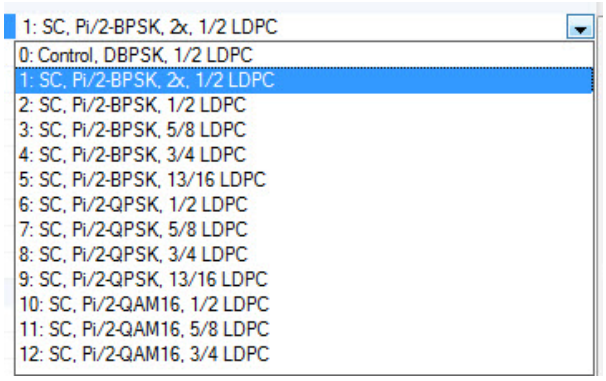
These functions relate to generation of an 802.11ad waveform which can be applied to the DUT as a stimulus for testing purposes. For more information on the 802.11ad standard, its packet structure, and its modulation and coding scheme, “Radio Standard: IEEE 802.11ad-2012 PHY” on page 113.

802.11ad Segment Settings

Figure 2-21 Settings window for a waveform segment



The settings are described in the following table.

Setting	Description / SCPI Command
Header:	
Modulation and Coding Scheme (MCS)	Drop down menu: select one of twelve choices:  Select the Modulation and Coding Scheme (MCS 0 - 12) for all the packets in this segment. The default selection is MCS 1 (SC, Pi/2-BPSK, 1/2 LDPC). See SCPI command: `[:SOURce]:RADio:AD:MCS`

Length (octets)	Set the PHY PSDU length in octets. For Control PHY segments (MCS0) this is limited to the range 14 to 1023 and has a default value of 120. For non-Control PHY segments (MCS1-MCS12) it is limited to the range 0 to 262143 and has a default value of 1000.
	See SCPI commands:
	`[:SOURce]:RADio:AD:LENgth:CPHY`
	`[:SOURce]:RADio:AD:LENgth:NCPHy`

Scrambler Initialization	Set the scrambler initialization pattern (the entered value seeds the scrambler which is applied to the remainder of the header and payload). For Control PHY segments (MCS0), the least significant 4 bits are used to seed the scrambler; the default setting is 02 hex. For non-Control PHY segments (MCS1-MCS12), the least significant 7 bits are used; the default setting is 42 hex.
	See SCPI commands:
	`[:SOURce]:RADio:AD:SINit:CPHY`
	`[:SOURce]:RADio:AD:SINit:NCPHy`

Additional PPDU	Drop down menu: select True or False. (False is the default selection.) True indicates that this PPDU is immediately followed by another PPDU with no IFS or preamble on the subsequent PPDU. False indicates no additional PPDU follows this PPDU. See SCPI command `[:SOURce]:RADio:AD:PPDU`
Packet Type	Drop down menu: select TRN-R (the default selection) or TRN-T. TRN-R indicates either a packet whose data part is followed by one or more TRN-R subfields, or a packet that is requesting TRN-R subfields to be appended to a future response. TRN-T indicates a packet whose data part is followed by one or more TRN-T subfields. See SCPI command `[:SOURce]:RADio:AD:PTYPE`

Setting	Description / SCPI Command
Training Length	Select the length of the optional beam-forming training field at the end of the packet. The default value is zero. See SCPI command `[:SOURce]:RADio:AD:TLENgth`
Aggregation	Drop down menu: select True or False. (False is the default selection.) True indicates that the PPDU in the data portion of the packet contains an A-MPDU. False indicates this is a packet without A-MPDU. See SCPI command `[:SOURce]:RADio:AD:AGGRegation`
Beam Tracking	Drop down menu: select True or False. (False is the default selection.) True indicates that beam tracking is needed. False indicates that beam tracking is not needed. See SCPI command `[:SOURce]:RADio:AD:BTRacking`
Last RSSI	Received Signal Strength Indicator for the last received packet. Value of 0 (the default setting) indicates that the previous packet was not received an SIFS period before the current transmission. Value of 1 represents a power less than or equal to –68 dBm. Value of 2 to 14 represent power levels (–71+value×2) dBm. Value of 15 represents a power greater than or equal to –42 dBm. See SCPI command `[:SOURce]:RADio:AD:LRSS`
Turnaround	Drop down menu: select True or False. (False is the default selection.) True sets the Turnaround (SIFS Response) bit. False clears the Turnaround (SIFS Response) bit. See SCPI command `[:SOURce]:RADio:AD:SIFS`

Setting	Description / SCPI Command
Modulation:	
SC Shaping Filter	Drop down menu: select None | Gaussian | Raised-Cosine | Root Raised-Cosine. Root Raised-Cosine is the default selection. Select the spectrum shaping applied to all Single Carrier (SC) and Low Power Single Carrier (LPSC) modulated packets. MCS0-12. 25-27. See SCPI command `[:SOURce]:RADio:AD:SHAPing`
Shaping Filter BT/Shape	This sets the BT product for Gaussian filtering and the shape factor for RC/RRC filtering. The default setting is 0.250. See SCPI command `[:SOURce]:RADio:AD:ALPHa`
Symbol Clock Offset	Symbol clock offset in ppm. The default setting is 0.0 ppm. See SCPI command `[:SOURce]:RADio:AD:COFFset`
Payload:	
Payload Content	Drop down menu: select PN23 | All 1's | All 0's | 8-bit Count | 32-bit Count | From File. 8-bit Count is the default selection. If From File is selected, the Payload Content File selection (see below) is used to identify the file holding the customized content. Determines the PSDU data content. See SCPI command `[:SOURce]:RADio:AD:CONTent[:TYPE]`
Payload Content File	If Payload Content (see above) is set to From File the data in this file will be used as the payload. Click on the ellipsis icon to open the file browser and select the file; the chosen file path will then be displayed. The file should be a text file containing 1's and 0's (any other characters such as spaces or carriage returns will be ignored). If the end of file is reached, reading will start at the beginning again (e.g. if the payload is longer than the amount of data in the file). See SCPI command `[:SOURce]:RADio:AD:CONTent:FILE`
Payload FCS On	Drop down menu: select True or False. (False is the default selection.) If the FCS On is set to True, there is a 32-bit FCS (Frame Check Sequence) at the end of the payload content. See SCPI command `[:SOURce]:RADio:AD:CONTent:FCSequence`
Waveform Structure:	
Interpacket Gap	The Inter-packet gap value determines the duration of the zero signal energy period preceding each packet. The value is limited to 0 to 200 μs. The default value is 2 μs. See SCPI command `[:SOURce]:RADio:AD:GAP`
Packets in Waveform	This controls how many different packets are generated in the segment. If the segment is specified to contain more than one packet and the payload is specified as PN data, then the PN sequence runs on through all packets in the segment. The advantage of specifying more than one packet in the segment (assuming a pseudo-random payload) is that the RF spectrum will be more random. The disadvantage is that the resulting output file will take longer to generate and will be larger. The default setting is 1; the maximum setting is 80. See SCPI command `[:SOURce]:RADio:AD:NPACkets`

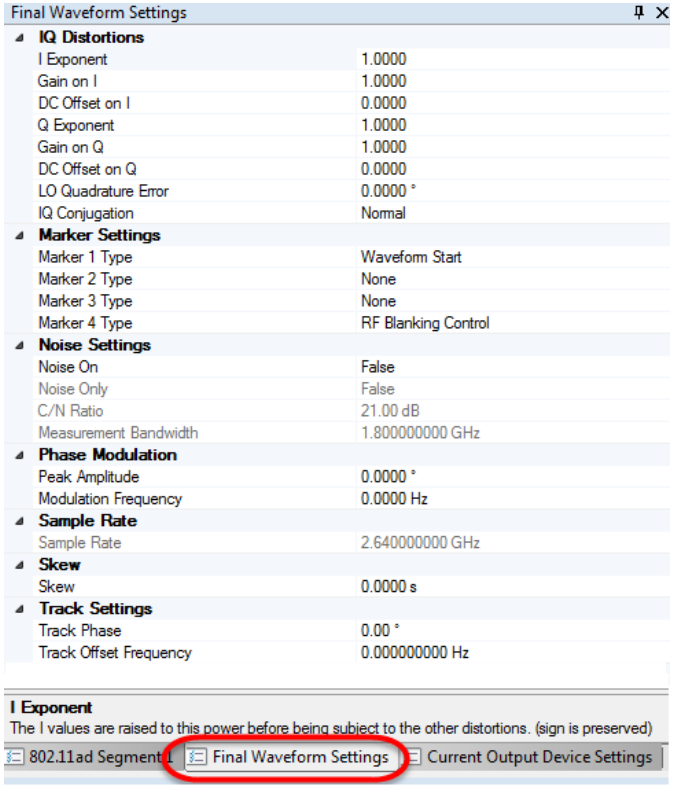
Setting	Description / SCPI Command
Preamble On	Drop down menu: select True (the default value) or False. When true, the preamble is generated. When false, no preamble is generated. This can be used in conjunction with the APPDU and Interpacket Gap settings to generate Additional PPDU packets. Select True or False from the drop down menu. See SCPI command `[:SOURce]:RADio:AD:PREamble`

Final Waveform Settings

NOTE

The Sample Rate settings are included here only to display information about the waveform; these parameters are not settable and there are no equivalent commands for them.

Figure 2-22 Final Waveform Settings windows



The settings are described in the following table.

Setting	Description / SCPI Command
IQ Distortions:	
I Exponent	The I value is raised to this power before being subject to the other distortions. (Sign is preserved.) The range is 0 to 10. The default selection is 1. See SCPI command `:OUTPut:NOISe:IMPairments:EXPonent:I` This feature requires license E7760A-CG1.
Gain on I	The linear gain on I. The range is -100 to +100. The default selection is 1. See SCPI command `:OUTPut:NOISe:IMPairments:GAIN:I` This feature requires license E7760A-CG1.

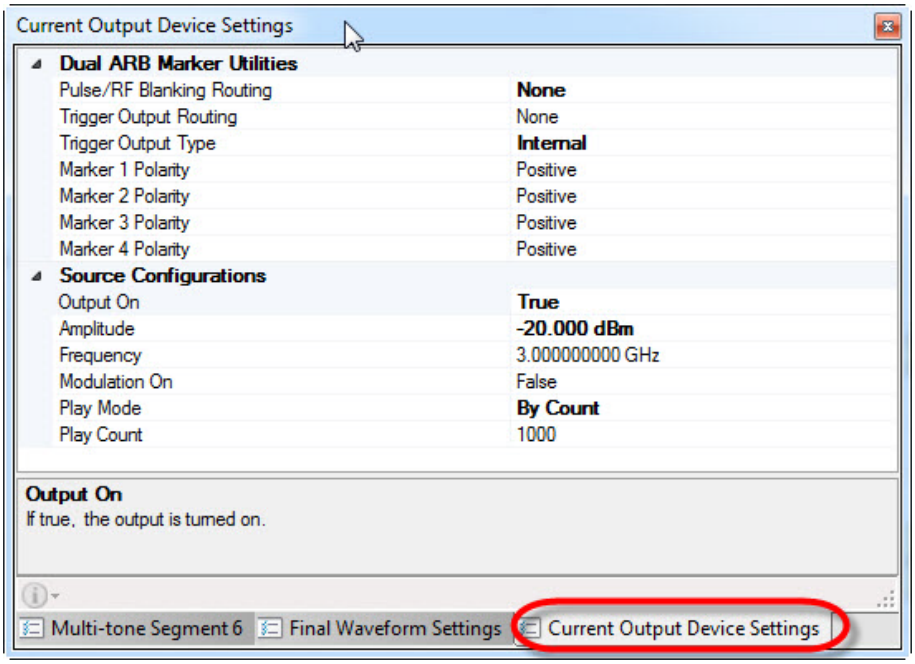
Setting	Description / SCPI Command
DC Offset on I	The DC offset present on the real axis, expressed as a fraction of 1.0 = constellation axis magnitude. The range is -100 to +100. The default selection is 0. See SCPI command `:OUTPut:NOISe:IMPairments:DC:I` This feature requires license E7760A-CG1.
Q Exponent	The Q value is raised to this power before being subject to the other distortions. (Sign is preserved.) The range is 0 to 10. The default selection is 1. See SCPI command `:OUTPut:NOISe:IMPairments:EXPonent:Q` This feature requires license E7760A-CG1.
Gain on Q	The linear gain on Q. The range is -100 to +100. The default selection is 1. See SCPI command `:OUTPut:NOISe:IMPairments:GAIN:Q` This feature requires license E7760A-CG1.
DC Offset on Q	The DC offset present on the imaginary axis, expressed as a fraction of 1.0 = constellation axis magnitude. The range is -100 to +100. The default selection is 0. See SCPI command `:OUTPut:NOISe:IMPairments:DC:Q` This feature requires license E7760A-CG1.
LO Quadrature Error	The deviation from perfect quadrature in the I and Q axis, in degrees. The range is -360 to +360. The default selection is 0. See SCPI command `:OUTPut:NOISe:IMPairments:QERRor` This feature requires license E7760A-CG1.
IQ Conjugation	Drop down menu: Select Normal | Invert Q | Swap I and Q. Determines whether Q and Q will be output normally, or the Q values will be inverted, or the I and Q values will be swapped. The default selection is Normal. See SCPI command `:OUTPut:NOISe:IMPairments:IQConj` This feature requires license E7760A-CG1.
Marker Settings:	
Marker 1 Type	Drop down menu: Select None | Waveform Start | RF Blanking Control. Select the type of source to be used for the Marker. Waveform Start is the default selection. See SCPI command `[:SOURce]:RADio:MARKer1:TYPE` RF Blanking Control requires license E7760A-RFB.
Marker 2 Type	Drop down menu: Select None | Waveform Start | RF Blanking Control. Select the type of source to be used for the Marker. None is the default selection. See SCPI command `[:SOURce]:RADio:MARKer2:TYPE` RF Blanking Control requires license E7760A-RFB.
Marker 3 Type	Drop down menu: Select None | Waveform Start | RF Blanking Control. Select the type of source to be used for the Marker. None is the default selection. See SCPI command `[:SOURce]:RADio:MARKer3:TYPE` RF Blanking Control requires license E7760A-RFB.

Setting	Description / SCPI Command
Marker 4 Type	Drop down menu: Select None | Waveform Start | RF Blanking Control. Select the type of source to be used for the Marker. RF Blanking Control is the default selection. See SCPI command `[:SOURce]:RADio:MARKer4:TYPE` RF Blanking Control requires license E7760A-RFB.
Noise Settings	
Noise On	Drop down menu: Select True | False. If true, noise is added to the generated waveform file at the specified C/N ratio as measured in the specified measurement bandwidth. False is the default selection. See SCPI command `:OUTPut:NOISe[:STATe]` This feature requires license E7760A-CG1.
Noise Only	Drop down menu: Select True | False. When noise generation is enabled and this is True, the waveform file will contain noise only; at the same power level it would have were the signal also present. This allows you to measure the in-band power level directly. False is the default selection. See SCPI command `:OUTPut:NOISe:NONLy` This feature requires license E7760A-CG1.
C/N Ratio	This sets the carrier to noise ratio that will be applied to the signal in the specified measurement bandwidth. The range is -20 to 90 dB. The default selection is 21 dB. See SCPI command `:OUTPut:NOISe:CNRatio` This feature requires license E7760A-CG1.
Measurement Bandwidth	This is the bandwidth in which the carrier to noise ratio is measured. Normally, this should be set to match the occupied bandwidth of the signal. The range is 0 Hz to 100 GHz. The default selection is 1.8 GHz. See SCPI command `:OUTPut:NOISe:OBWidth` This feature requires license E7760A-CG1.
Phase Modulation	
Peak Amplitude	This impairment applies sinusoidal phase modulation to the waveform. This sets the peak phase rotation. For example, with the value set to 20°, a constellation point at 0° will oscillate sinusoidally between +20° and -20°. The range is -360 to +360. The default selection is 0. See SCPI command `:OUTPut:NOISe:IMPairments:PMODulation:AMPLitude` This feature requires license E7760A-CG1.
Modulation Frequency	The frequency of the sinusoidal phase modulation. The range is 0 Hz to 100 MHz. The default selection is 0 Hz. See SCPI command `:OUTPut:NOISe:IMPairments:PMODulation:FREQuency` This feature requires license E7760A-CG1.

Setting	Description / SCPI Command
Sample Rate:	
Sample Rate	The sample rate for the final waveform. This is displayed information, not a settable parameter; there is no equivalent SCPI command.
Skew	
Skew	Enter the skew value in ns. If this is set to a non-zero value, the real and imaginary parts of the waveform are generated with a time skew between them. If the skew value is positive, the real component will lead the imaginary; if the skew value is negative, the real component will lag the imaginary. Skew is applied on a per-segment basis, so if there are discontinuities between segments, skew can make this more pronounced. The range is -10 to +10 ns. The default selection is 0. See SCPI command `:OUTPut:NOISe:IMPairments:SKEW` This feature requires license E7760A-CG1.
Track Settings:	
Track Phase	This sets the phase factor for the track, in degrees. (A phase of 180 degrees essentially means this waveform will be subtracted.) 0.00 is the default value. The range is -360 to +360. See SCPI command `[:SOURce]:TRACk:PHASe`
Track Offset Frequency	Track Offset Frequency. This sets the Offset Frequency for the track. A zero value means no upconversion; for values greater than zero, the track will be upconverted to the specified IF. Please note that for a given sample rate, the maximum valid offset will be equal to (Sample rate / 2.56) – (0.5 * Signal BW). 0 is the default setting. The range is -100000 MHz to +100000 MHz. See SCPI command `[:SOURce]:TRACk:IFRequency`

Current Output Device Settings

Figure 2-23 Current Output Device Settings windows



The settings are described in the following table.

Setting	Description / SCPI Command
Dual ARB Marker Utilities:	
Pulse/RF Blanking	Drop down menu: Select None | Marker 1 | Marker 2 | Marker 3 | Marker 4 Select the Pulse/RF Blanking marker routing (Marker 1, 2, 3, 4, or None). None is the default selection. See SCPI command `:OUTPut:ARB:MDEStination:PULSe` RF Blanking requires license E7760A-RFB.
Trigger Output Routing	Drop down menu: Select None | Marker 1 | Marker 2 | Marker 3 | Marker 4 Select the Trigger Output marker routing (Marker 1, 2, 3, 4, or None). None is the default selection. See SCPI command `:OUTPut:ARB:MDEStination:TRIGger`
Trigger Output Type	Drop down menu: Select Internal | External 2 Set the trigger output type (Internal or External 2). The default setting is Internal. If External 2 is selected, the marker output is supplied to the TRIG 2 connector on the E7760A rear panel. See SCPI command: `OUTPut:ARB:TRIGger:OUTPut`
Marker 1 Polarity	Drop down menu: select Positive (the default setting) or Negative. Set polarity of Marker 1. See SCPI command `:OUTPut:ARB:MPOLarity:MARKer1`

Setting	Description / SCPI Command
Marker 2 Polarity	Drop down menu: select Positive (the default setting) or Negative. Set polarity of Marker 2. See SCPI command `:OUTPut:ARB:MPOLarity:MARKer2`
Marker 3 Polarity	Drop down menu: select Positive (the default setting) or Negative. Set polarity of Marker 3. See SCPI command `:OUTPut:ARB:MPOLarity:MARKer3`
Marker 4 Polarity	Drop down menu: select Positive (the default setting) or Negative. Set polarity of Marker 4. See SCPI command `:OUTPut:ARB:MPOLarity:MARKer4`
Source Configurations:	
Output On	Drop down menu: select True (the default selection) or False. If true, the output is turned on. It is necessary to turn the output off to make changes to the 802.11ad segment; after making the changes, select **Generate and Output**, then turn the output on again. Also, it is necessary to turn the output off before setting an output port to **None** in the **System Configurations** window. See SCPI command `:OUTPut:STATe`
Amplitude	Set the source output power level in dBm. -20 is the default setting. The range is -70 to +10. See SCPI command `:OUTPut:POWer[:AMPLitude]`
Frequency	Allows you to adjust the source frequency, in GHz. If the Output Port on the System Configurations menu is set to IF IO 1 or IF IO 2, the default value is 3 GHz and the range is 2 to 18 GHz. For other Output Port settings, the default value is 60 GHz and the range is 55 GHz to 68 GHz. See SCPI command `:OUTPut:FREQuency`
Modulation On	Drop down menu: select True or False. (False is the default value.) If true, the source output will be modulated. If false, the source will produce a continuous wave signal. See SCPI command `:OUTPut:MODulation[:STATe]`
Play Mode	Drop down menu: select By Count (the default selection) or Continuous. Set the output device waveform playing mode. See SCPI command `:OUTPut:PLAY:MODE`
Play Count	Set the number of times the waveform is to be played. This setting can be made only if By Count is selected for Play Mode (see above). 1000 is the default setting. The range is 1 to 100,000,000. See SCPI command `:OUTPut:PLAY:COUNt`

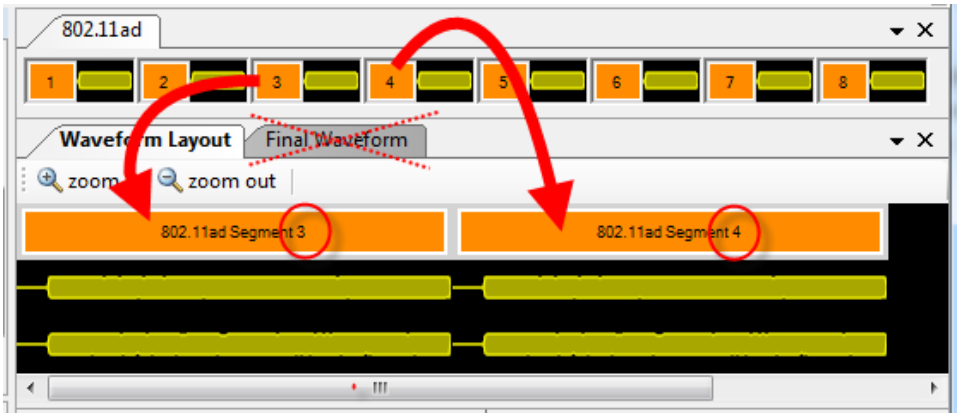
802.11ad Segment Library

Eight 802.11ad waveform segments are available in the segment library (the tab for this reads simply **802.11ad**).

Figure 2-24 802.11ad Segment Library

Segments can be added to the waveform by dragging them to the **Waveform Layout** window immediately below. (Avoid dragging the cursor over the **Final Waveform** tab, because that will open the wrong window.)

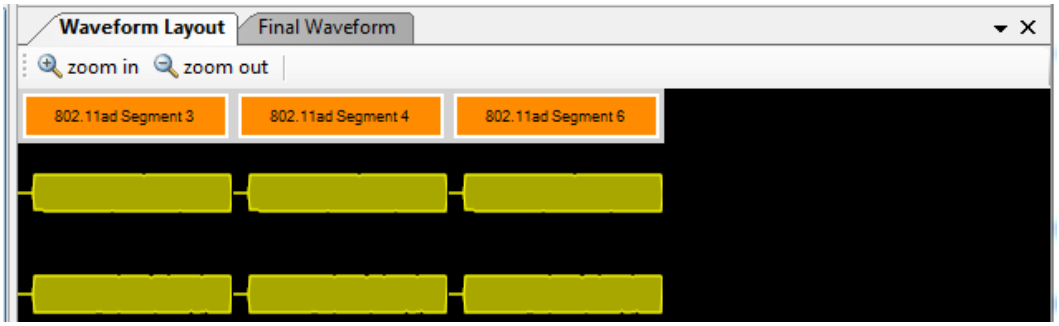
Figure 2-25 Adding a Segment



Waveform Layout

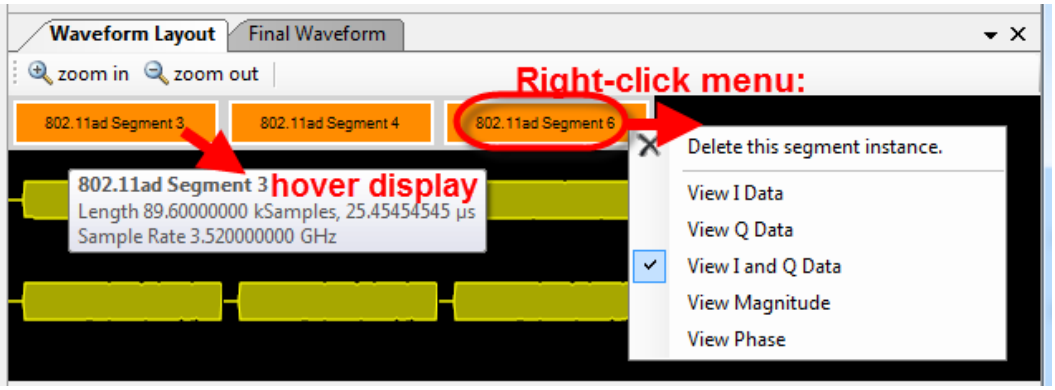
The waveform segments are displayed in sequence:

Figure 2-26 Waveform Layout window



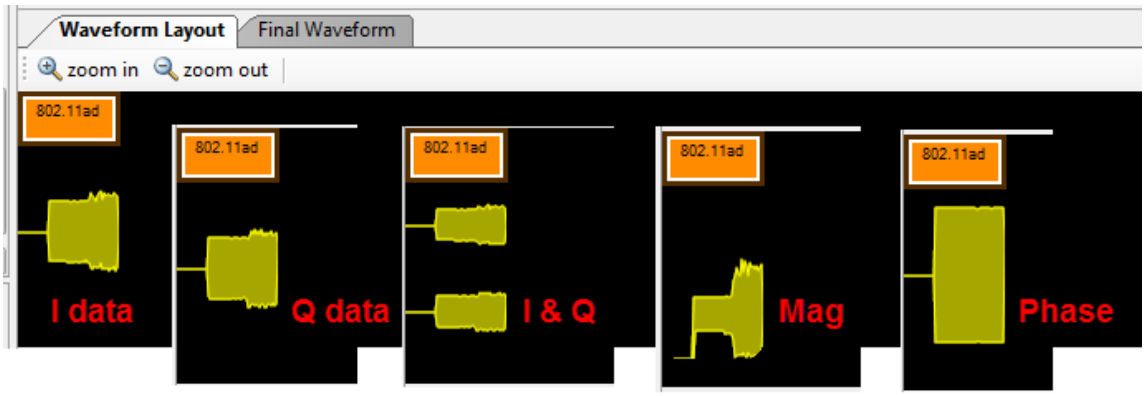
Holding the mouse over the name of a segment will cause additional information about the segment to be displayed. Right-clicking on the segment opens a menu:

Figure 2-27 Waveform segment hover display and right-click menu



The selections in the right-click menu can be used to delete a segment, or to display I data, Q data, I and Q data, magnitude, or phase.

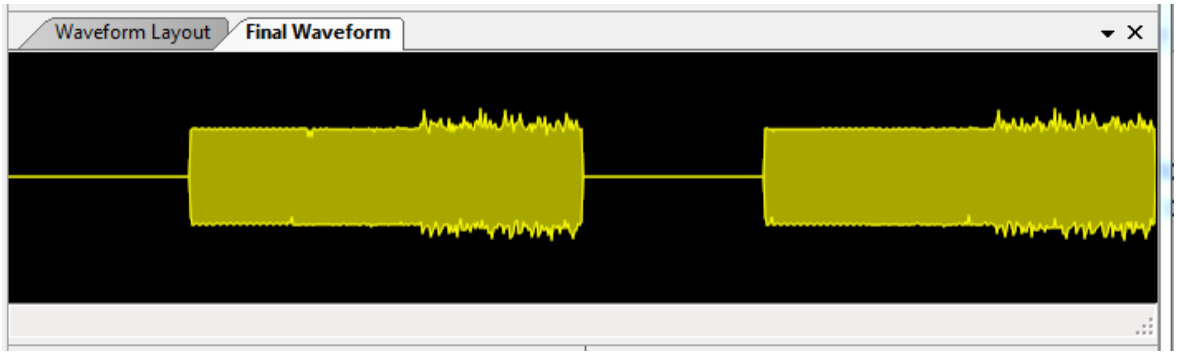
Figure 2-28 Waveform Layout right-click "View Data" options



Final Waveform

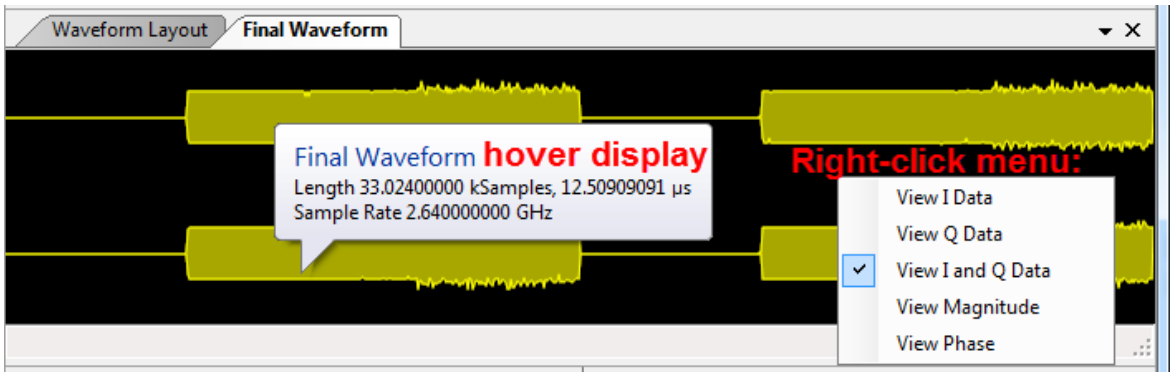
The full waveform is displayed, with all of its waveform segments:

Figure 2-29 Final Waveform window



Holding the mouse over the waveform will cause additional information about it to be displayed. Right-clicking on the display opens a menu:

Figure 2-30 Final Waveform hover display and right-click menu



As in the case of the **Waveform Layout** window, selections in the right-click menu can be used to display I data, Q data, I and Q data, magnitude, or phase.

Generator Waveform Optimization

The instrument has the ability to save a finite number of waveforms in ARB memory and avoid the expense of regenerating a waveform.

The absolute number of waveforms that can be held in ARB memory is dynamic, there is no hard-limit. It is recommended that less than 25 waveforms be held in ARB memory.

Waveforms in ARB memory are referenced by a user supplied name. The ARB can be queried to determine the waveforms resident in memory.

NOTE

When playing a waveform from memory, the **Generate And Output** function or `:OUTPut:DEVice:RUN` command will supplant the currently running waveform with a newly generated waveform; for correct waveform playback, make sure you are not using those operations.

NOTE

Power-cycling the instrument, or exiting and restarting the 802.11ad application, will erase the waveforms in ARB memory.

Programming Example

```
// Configure waveform settings:
OUTP:STAT OFF // Ensure Generator is OFF
TRAC:SLIS:CLE // Ensure Segment List is clear
RAD:AD1:CONT PN23
RAD:AD1:CONT:FCS 1
RAD:AD1:NPAC 1
TRAC:SLIST:ADD AD,1   // Add Segment into waveform

// Configure 2nd waveform to hold in ARB memory
RAD:AD1:MCS 8  // Configure for MCS8
OUTP:DEV:NRUN ‘PreGenMCS8’ // Generates & Outputs waveform and
saves in ARB memory with name PreGenMCS8

// Configure 3rd waveform to hold in ARB memory
RAD:AD1:MCS 12  // Configure for MCS12
OUTP:DEV:NRUN ‘PreGenMCS12’ // Generates & Outputs waveform and
saves in ARB memory with name PreGenMCS12

// Now that 3 waveforms are generated and housed in ARB memory,
playing the waveform saves the time of re-generating:
OUTP:STAT ON // Enable Generator output
OUTP:DEV:NRUN ‘PreGenMCS3’  // Pre-Generated waveform using MCS3 is
playing
OUTP:DEV:NRUN ‘PreGenMCS8’  // Pre-Generated waveform using MCS3 is
playing
OUTP:DEV:NRUN ‘PreGenMCS12’  // Pre-Generated waveform using MCS3
is playing
```

Related Functions & Commands

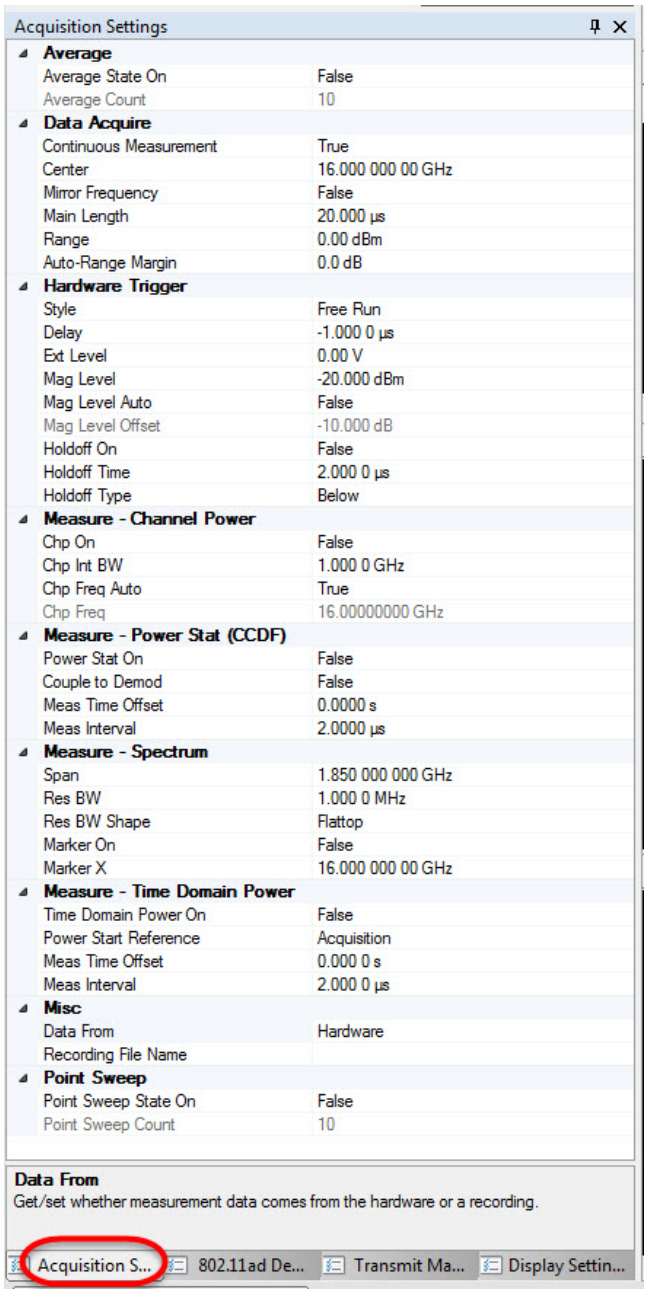
- “Generate menu” on page 42
- :OUTPut:DEVice:ARB: commands under “:OUTPut:DEVice Commands” on page 215

Receive Functions

These settings relate to measurements performed on an 802.11ad waveform received from the DUT.

Acquisition Settings

Figure 2-31 Acquisition Settings windows



The settings are described in the following table.

Setting	Description / SCPI Command
Average:	
Average State On	Drop down menu: select True or False. (False is the default selection). If True is selected, all measurements will be averaged. See SCPI command `:SENSe:AVERage[:STATe]`
Average Count	Set the count for measurement averaging. (The setting has no effect if averaging is not enabled; see Average State On above.) The range is 1 to 50. The default setting is 10. See SCPI command `:SENSe:AVERage:COUNt`
Data Acquire:	
Continuous Measurement	Drop down menu: select True or False. If the setting is True, the measurement will run continuously; if False, the measurement will stop after one cycle. The default setting is True. See SCPI command `:INITiate:CONTinuous`
Center	Enter the measurement center frequency. This should match the **Frequency** setting under **Current Output Device Settings > Source Configurations**. If the **Output Port** on the **System Configurations** menu is set to IF IO 1 or IF IO 2, the default value is 3 GHz and the range is 2 to 18 GHz. For other Output Port settings, the default value is 60 GHz and the range is 55 GHz to 68 GHz. See SCPI command `:SENSe:FREQuency:CENTer`
Main Length	Enter the main time length. The default value is 10 µs. The range is 15.152 ns to 1 ms. SCPI command `:SENSe:TIME:LENGth`
Range	Enter the input power range (in dBm). The default setting is 0. The range is -50 to +20. See SCPI command `:INPut:CHANnel:RANGe`
Auto-Range Margin	Enter the margin (in dB) to be applied to the Auto Range action. For devices that encounter overloading after Auto Range with the default margin of 0 dB, use a positive margin setting. The range is -10 to +10. See SCPI command `:INPut:RANGe:AUTO:MARGin`
Hard ware Trigger:	
Style	Drop down menu: select Free Run | Video | RF Burst | External1 | Internal. Select the trigger style. The default selection is Free Run. If External is selected, the external trigger signal must applied to the TRIG 1 connector on the E7760A rear panel. See SCPI command `:TRIGger:HW:STYLe`
Delay	Enter the trigger delay in seconds. The default value is -1 µs. The range is -1 ms to +1 ms. The length of a negative delay cannot exceed the setting for **Acquisition Settings > Data Acquire > Main Length**. See SCPI command `:TRIGger:HW:DELay`
Ext Level	Enter the external trigger level in V. The default setting is 0. The range is 0 to 5. See SCPI command `:TRIGger:HW:EXTernal:LEVel`

Setting	Description / SCPI Command
Mag Level	Enter the magnitude trigger level in dBm, if the Style setting (see above) is Video or RF Burst. The default setting is -20. The range is -60 to +10. See SCPI command `:TRIGger:HW:MAGnitude:LEVel`
Mag Level Auto	Drop down menu: select True or False. Enable or disable the automatic setting of the trigger Mag Level when the Range setting is changed. False is the default state. See SCPI command `:TRIGger:HW:MAGnitude:LEVel:AUTO`
Mag Level Offset	Enter the offset in dB from the Range setting at which the Mag Level of the trigger will occur, if the Mag Level Auto setting (see above) is True. The default setting is -10 dB. The range is -100 to +100. See SCPI command `:TRIGger:HW:MAGnitude:LEVel:OFFSet`
Holdoff On	Drop down menu: select True or False. Enable or disable the trigger holdoff state by selecting True or False. False is the default state. See SCPI command `:TRIGger:HW:HOLDoff:STATe`
Holdoff Time	Enter the trigger holdoff time in seconds. The default setting is 2 µs. The range is 0 to 1 ms. See SCPI command `:TRIGger:HW:HOLDoff:TIME`
Holdoff Type	Drop down menu: select Below|Above. Select the trigger holdoff type. The default selection is Below. See SCPI command `:TRIGger:HW:HOLDoff:TYPE`
Measure - Channel Power:	
Chp On	Drop down menu: select True or False. Select True or False to enable or disable the channel power measurement. The measurement is disabled by default. See SCPI command `:SENSe:CHPower[:STATe]`
Chp Int BW	Enter the integration bandwidth of the channel power measurement, in Hz. The default value is 1 GHz. The range is 100 kHz to 1.85 GHz. See SCPI command `:SENSe:CHPower:BANDwidth:INTegration`
Chp Freq Auto	Drop down menu: select True or False. True is the default selection. Select True or False to enable or disable the Auto mode for the frequency of channel power measurement. If Auto is enabled, the channel power measurement will use the center frequency of the capture. If disabled, the channel power measurement will use the center frequency specified by the **Chp Freq** setting below. See SCPI command `:SENSe:CHPower:FREQuency:AUTO`
Chp Freq	Enter the center frequency for the channel power measurement (this is applicable only if the **Chp Freq Auto** setting above is set to False). If the **Input Port** on the **System Configurations** menu is set to IF IO 1 or IF IO 2, the default value is 3 GHz and the range is 2 to 18 GHz. For other Input Port settings, the default value is 60 GHz and the range is 55 GHz to 68 GHz. See SCPI command `:SENSe:CHPower:FREQuency`

Setting	Description / SCPI Command
Measure - Power Stat (CCDF):	
Power Stat On	Drop down menu: select True or False. (False is the default setting.) Select True or False to enable or disable the Power Stat (CCDF) measurement. See SCPI command `:SENSe:PSTatistic[:STATe]`
Couple to Demod	Drop down menu: select True or False. (False is the default setting.) Select True or False to enable or disable coupling of the Power Stat (CCDF) measurement to the demodulation measurement. If the measurements are coupled, the Power Stat measurement will use the packet's start time and packet length (which are calculated by demodulation) to calculate the power statistics (in this case, if demodulation measurement is not turned on, NAN values will be returned). If the measurements are not coupled, the Power Stat measurement will use its own start time and measurement interval to calculate the power statistics. See SCPI command `:SENSe:PSTatistic:CDEMod`
Meas Time Offset	Enter the time offset, relative to the start boundary, of the Power Stat (CCDF) measurement, in seconds. The query returns the current setting. Range: 0 or greater. Default: 0. The value can also be given in MIN or HR. This setting is relevant only if the power stat measurement is not coupled to the demodulation measurement (see the **Couple to Demod** setting above). The default setting is 0 seconds. See SCPI command `:SENSe:PSTatistic:TIME:STARt`
Meas Interval	Enter the measurement interval of the Power Stat (CCDF) measurement, in seconds. The query returns the current setting. The default setting is 2 μs. The value can also be given in MIN or HR. This setting is relevant only if the power stat measurement is not coupled to the demodulation measurement (see the **Couple to Demod** setting above). See SCPI command `:SENSe:PSTatistic:TIME:INTerval`
Measure - Spectrum:	
Span	Enter the measurement frequency span in Hz. The default value is 1.85 GHz. The range is 10 MHz to 2.112 GHz. See SCPI command `:SENSe:FREQuency:SPAN`
Res BW	Enter the resolution bandwidth (RBW). The default value is 1 MHz. The range is 100 kHz to 10 MHz. See SCPI command `:SENSe:FREQuency:BANDwidth:VALue`
Res BW Shape	Drop down menu: select Flattop (the default setting) or Gaussian. Select the filter type for resolution bandwidth. See SCPI command `:SENSe:FREQuency:BANDwidth:SHAPe`
Marker On	Drop down menu: select True or False. (False is the default selection.) Enable or disable the spectrum marker. See SCPI command `:CALCulate:SPECtrum:MARKer[:STATe]`
Marker X	Enter the x-axis value of marker, in Hz. The default setting is 3 GHz. See SCPI command `:CALCulate:SPECtrum:MARKer:X`

Setting	Description / SCPI Command
Measure - Time Domain Power:	
Time Domain Power On	Drop down menu: select True or False. (False is the default selection.) Enable or disable the time domain power measurement. See SCPI command `:SENSe:TDPower[:STATe]`
Power Start Reference	Drop down menu: select Acquisition (the default selection) or Packet. Select the reference start boundary of the time domain power measurement. The choices are Acquisition (the start point of the acquisition is the reference boundary) or Packet (the start point of the packet is the reference boundary). For most general-purpose uses, Acquisition is the recommended setting. See SCPI command `:SENSe:TDPower:TIME:REFerence`
Power Time Offset	Enter the time offset, relative to the start boundary, of the time domain power measurement in seconds. The default setting is 0. The range is 0 or greater. See SCPI command `:SENSe:TDPower:TIME:STARt`
Power Time Interval	Enter the time interval of the time domain power measurement in seconds. The default value is 2 µs. The range is 0 or greater. See SCPI command `:SENSe:TDPower:TIME:INTerval`
Measure - Misc:	
Data From	Drop down menu: select Hardware (the default selection) or Recording. Select the source of measurement data (from the hardware, or from a recording). (Data can be recorded by right-clicking on the displayed data in the Main Time result window, and selecting Save IQ Data As on the pop-up menu which appears.) See SCPI command `:INPut:DATA:FEED` This feature requires license E7760A-RFP.
Recording File Name	Ellipsis menu: select a file to be used as the source of recorded data to be measured, if **Data From** (see above) has been set to **Recording**. (Data can be recorded by right-clicking on the displayed data in the Main Time result window, and selecting Save IQ Data As on the pop-up menu which appears.) See SCPI command `:INPut:RECording:NAME` This feature requires license E7760A-RFP.
Point Sweep:	
Point Sweep State On	Drop down menu: select True or False. (False is the default selection.) Enable or disable Point Sweep measurement. This measurement performs a Channel Power measurement with each trigger event until the Point Sweep Count is reached. See SCPI command `:SENSe:SWEep[:STATe]`
Point Sweep Count	Enter the number of Channel Power results to acquire for the Point Sweep measurement. (The setting has no effect if Point Sweep State On is not enabled; see the setting above.) The default setting is 10. The range is 1 to 1000. See SCPI command `:SENSe:SWEep:POINt`

Point Sweep Measurement

This measurement performs a series of Channel Power measurements. It is intended for remote control operation, even though the ON/OFF state and number of measurements can be configured via the graphical user interface.

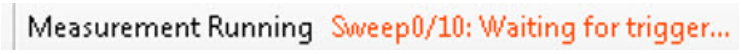
When Point Sweep State is ON, a channel power measurement is taken when the trigger condition is met. The individual measurements are held in memory until the Point Sweep Count is achieved, upon which the results can be queried remotely.dd

Programming Example

```
INIT:CONT 0  // Set measurement mode to Single
SENS:SWE 1 // Enable point sweep mode
SENS:SWE:POIN 10 // 10 measurements to be taken

SENS:CHP 1 // Enable Channel Power measurement
TRIG:HW:STYL EXT1 // Set trigger to external (Rear Panel port 1)
INIT // Start the point sweep measurement
```

The measurement status area will show that Point Sweep is at Measurement 0 of 10:



When a trigger is received on the External Trigger, a channel power measurement is taken and armed for the next trigger event. When the number of trigger events equals the number of point sweep measurements to be taken, the results are available with the query:

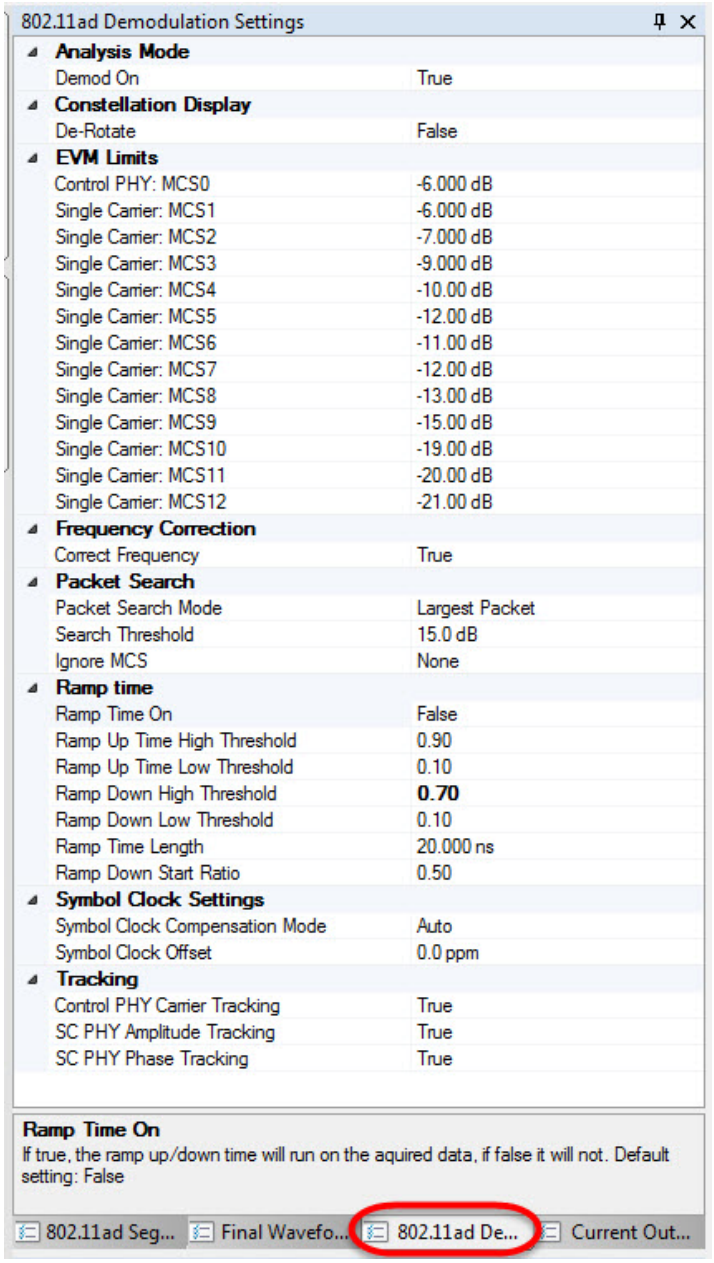
```
:FETC:CHP:SWE?  // retrieves the 10 channel power results
```

Related Functions & Commands

- **Point Sweep** selections under “Acquisition Settings” on page 74
- “:SENSe:SWEep Commnds” on page 248

802.11ad Demodulation Settings

Figure 2-32 802.11ad Demodulation Settings windows



The settings are described in the following table.

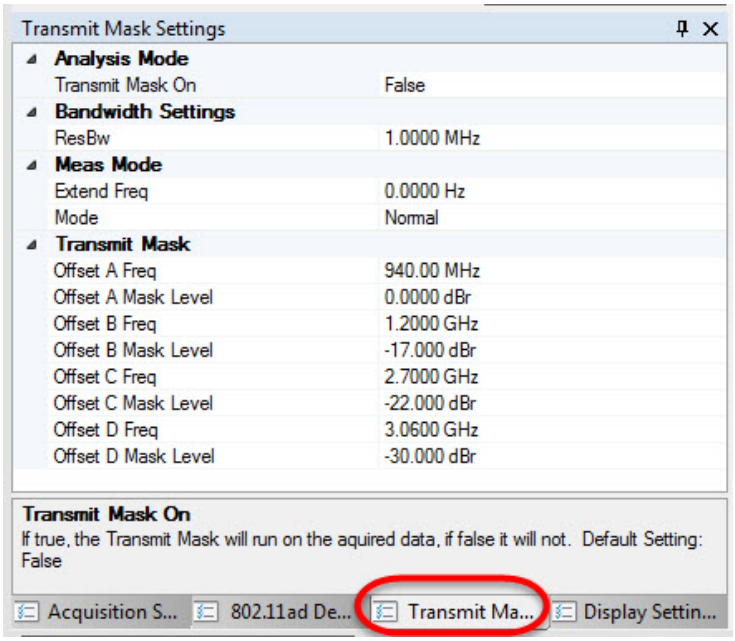
Setting	Description / SCPI Command
Analysis Mode:	
Demod On	Drop down menu: select True or False. (False is the default setting.) Select True or False to enable or disable demodulation of the acquired data. See SCPI command `:SENSe:DEModulation:AD[:STATe]`
Constellation Display:	
De-Rotate	Drop down menu: select True or False. (False is the default setting.) Select True to de-rotate the rotated n/2-BPSK constellation points; select False to leave them rotated. See SCPI command `:SENSe:DEModulation:AD:DERotate`
EVM Limits:	
Control PHY: MCSO	Enter the maximum permitted EVM for control physics (MCS0), in dB. If the EVM exceeds this value, the demodulation measurement will return a failure. The query returns the current state. The default value is -6. See SCPI command `:SENSe:DEModulation:AD:EVM:LIMit:CONTrol`
Single Carrier: MCS1-12	Enter the maximum permitted EVM for single-carrier physics (MCS1 - MCS12, as specified by the MCS parameter), in dB. If the EVM exceeds this MCS-dependent value, the demodulation measurement will return a failure. The query returns the current state. The default values are dependant on the MCS number, as follows: MCS1: -6, MCS2: -7, MCS3: -9, MCS4: -10, MCS5: -12, MCS6: -11 MCS7: -12, MCS8: -13, MCS9: -15, MCS10: -19, MCS11: -20, MCS12: -21 See SCPI command `:SENSe:DEModulation:AD:EVM:LIMit[:SCARrier]:MCS`
Frequency Correction:	
Correct Frequency	Drop down menu: select True (the default setting) or False. Select True or Fale to enable or disable frequency correction during demodulation measurement. If enabled, the calculated frequency error is compensated for, and a second correlation is performed, for a better EVM result. See SCPI command `:SENSe:DEModulation:AD:FREQuency:CORRect`

Setting	Description / SCPI Command
Packet Search:	
Packet Search Mode	Drop down menu: select Largest Packet (the default selection) or First Packet. This selection this determines which packet will be demodulated if multiple packets are present in the time record. Largest Packet means that the packet with the largest correlation spikes will be used. First Packet means that the demodulation measurement will look for the first RF burst that exceeds the limit set by the Search Threshold setting (see below). See SCPI command `:SENSe:DEModulation:AD:PSEarch`
Search Threshold	Enter the search threshold, in dB, which is used if the Packet Search Mode (see above) is set to First Packet. The default setting is 15. The range is 10 to 100. See SCPI command `:SENSe:DEModulation:AD:THReshold`
Ignore MCS	Drop down menu: select None or select one particular MCS packet to be ignored during demodulation. This capability allows skipping over a specific MCS packet when it is desired to analyze a different MCS. For example, your device may be always generating MCS0 followed by the particular MCS of interest. You can select Ignore MCS0 and the demodulation will occur on the next packet that contains a modulation other than MCS0.The default setting is None. The choices are None or MCS0 through MCS12. See SCPI command `:SENSe:DEModulation:AD:IGNore`
Ramp Time:	
Ramp Time On	Drop down menu: select True or False. (False is the default setting.) Select True or False to enable or disable transmit ramp up and ramp down time measurement. (To allow the measurement to be made using a modulated signal, this measurement filters the sampled data by taking the maximum sample in a moving window.) See SCPI command `:SENSe:DEModulation:AD:RAMP:TIME[:STATe]`
Ramp Up Time High Threshold	Enter the stop (high) threshold for the transmit power-up ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to rise from the lower to the upper threshold.) The default value is .9 (90%). The range is .01 to .99. See SCPI command: `:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:HIGH`
Ramp Up Time Low Threshold	Enter the start (low) threshold for the transmit power-up ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to rise from the lower to the upper threshold.) The default value is .1 (10%). The range is .01 to .99. See SCPI command: `:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:LOW`
Ramp Down High Threshold	Enter the start (high) threshold for the transmit power-down ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to fall from the upper to the lower threshold.) The default value is .9 (90%). The range is .01 to .99. See SCPI command: `:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:HIGH`

Setting	Description / SCPI Command
Ramp Down Low Threshold.	Enter the stop (low) threshold for the transmit power-down ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to fall from the upper to the lower threshold.) The default value is .1 (10%). The range is .01 to .99. See SCPI command: `:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:LOW`
Ramp Time Length	Enter the length for the search window to be used for the ramp up and down measurement. Note: if the length is too small, the ramp may not be found. The default value is 20 ns. The range is 5 to 50 ns. See SCPI command: `:SENSe:DEModulation:AD:RAMP:TIME:LENGth`
Ramp Down Start Ratio	Enter the location of the Packet Falling Edge within the Ramp Time Length. The default value of 0.50 places the packet falling edge in the center of the Ramp Time Length. Values < 0.5 move the packet falling edge earlier in the ramp time length, values > 0.9 move the packet falling edge later in the ramp time length. The default value is 0.50. The range is 0.10 to 0.90. See SCPI command: `:SENSe:DEModulation:AD:RAMP:TIME:DOWN:STARt`
Symbol Clock Settings:	
Symbol Clock Compensation Mode	Drop down menu: select Manual (the default selection) or Auto. Select the Symbol Clock Compensation Mode. If Auto is selected, the measured symbol clock offset estimate will be used. If Manual is selected, the user-specified Symbol Clock Offset (see below) will be used. See SCPI command `:SENSe:DEModulation:AD:SCLock:MODE`
Symbol Clock Offset	Enter the symbol clock offset in ppm, if Symbol Clock Compensation Mode is set to Manual (see above). The default setting is 0. The range is -900000 to +100. See SCPI command `:SENSe:DEModulation:AD:SCLock:VALue`
Tracking:	
Control PHY Carrier Tracking	Drop down menu: select True or False. (False is the default selection.) If True is selected, carrier tracking is applied when demodulating Control PHY packets. See SCPI command `:SENSe:DEModulation:AD:CPCTracking`
SC PHY Amplitude Tracking	Drop down menu: select True (the default selection) or False. If true, amplitude tracking is applied when demodulating SC PHY packets. See SCPI command `:SENSe:DEModulation:AD:SPATracking`
SC PHY Phase Tracking	Drop down menu: select True (the default selection) or False. If true, phase tracking is applied when demodulating SC PHY packets. See SCPI command `:SENSe:DEModulation:AD:SPPTracking`

Transmit Mask Settings

Figure 2-33 Transit Mask Settings windows



The settings are described in the following table.

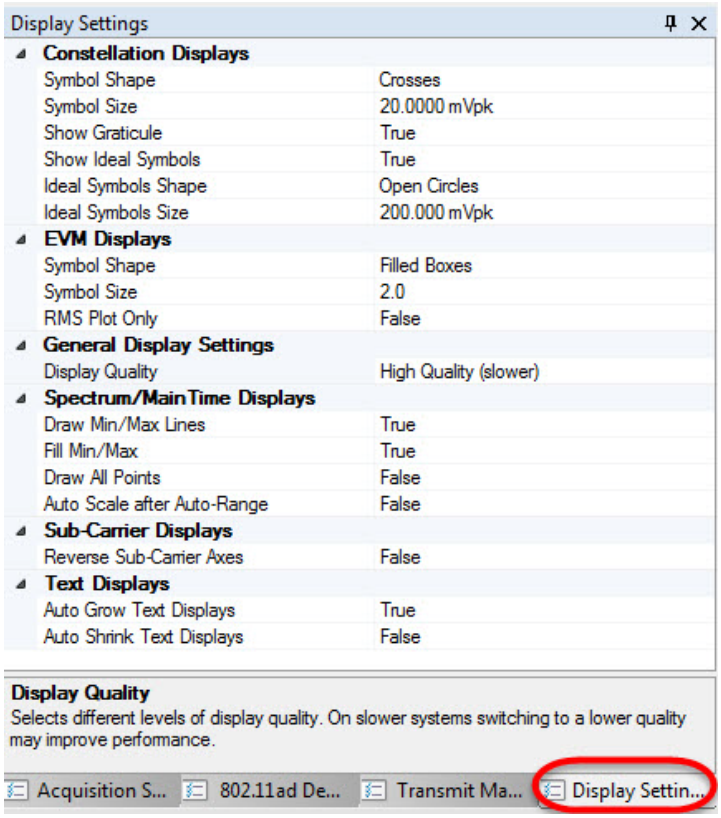
Setting	Description / SCPI Command
Analysis Mode:	
Transmit Mask On	Drop down menu: select True or False. (False is the default selection.) If true, the Transmit Mask will run on the acquired data, if false it will not. See SCPI command `:SENSe:SEMask[:STATe]`
NOTE	It is not possible to do the transmit mask measurement while the E7760A source output is on. To turn off the source, select **Current Output Device Settings > Source Configurations > Output On > False**.
Band wid th Settings:	
Res BW	Enter the Resolution Bandwidth for SEM in Hz. The default value is 1 MHz. The range is 100 kHz to 10 MHz. See SCPI command `:SENSe:SEMask:BANDwidth[:RESolution]`

Setting	Description / SCPI Command
Meas Mode:	
Extend Freq	Enter a value in Hz to extend the frequency for Offset D (see below) beyond the +/- 3.06 GHz range. The default setting is 0 Hz. The range is 0 to 629 MHz. Note that the Minimum Start Frequency or Maximum Stop Frequency of the selected Input Port may limit the range. See SCPI command `:SENSe:SEMask:EXTend:FREQuency`
Mode	Drop down menu: select Normal (the default selection) or High Dynamic Range. Select the measurement mode (Normal or High Dynamic Range) for transmit mask (SEM). The query returns the current setting. Normal is the default setting. Note that High Dynamic Range mode may not be compatible with the 802.11ad standard. See SCPI command `:SENSe:SEMask:MODE`
Offset A-D:	
Start Freq	Enter the frequency offsets for transmit mask (SEM). The default settings are: Offset A: 940 MHz, Offset B: 1.2 GHz Offset C: 2.7 GHz Offset D: 3.06 GHz (Regarding Offset D, see the Extend Freq setting above.) See SCPI command `:SENSe:SEMask:OFFSet:LIST:FREQuency`
Limit	Enter the limits of relative peak spectral density (in dBr) for transmit mask (SEM). The default settings are: Offset A: 0 dBr Offset B: -17 dBr Offset C: -22 dBr Offset D: -30 dBr See SCPI command `:SENSe:SEMask:OFFSet:LIST:LIMit`

Display Settings

These settings affect the display only; there are no SCPI command equivalents for them.

Figure 2-34 Display settings windows



The settings are described in the following table.

Setting	Description
Constellation Displays:	
Symbol Shape	Drop down menu: select the symbol shape for all constellation displays. The default selection is Crosses. Open Circles Filled Circles Crosses Diagonal Crosses Vertical Lines Horizontal Lines Boxes Filled Boxes Open Diamonds Filled Diamonds Dots None

Setting	Description
Symbol Size	Enter the size/diameter of the symbol shape for the constellation displays, in Vpk. The default setting is 20 mVpk. The range is 0 to 500 Vpk.
Show Graticule	Drop down menu: select True (the default selection) or False. If True is selected, the constellation graticule will be displayed.
Show Ideal Symbols	Drop down menu: select True (the default selection) or False. If True is selected, the ideal constellation symbols will be displayed.
Ideal Symbols Shape	Drop down menu: select the shape of the ideal constellation symbols for all constellation displays. The default selection is Open Circles. Open Circles Filled Circles Crosses Diagonal Crosses Vertical Lines Horizontal Lines Boxes Filled Boxes Open Diamonds Filled Diamonds Dots None
Ideal Symbols Size	Sets the size/diameter of the ideal constellation symbols for the constellation displays, in mVpk. The default setting is 200 mVpk. The range is 0 to 500 Vpk.
EVM Displays:	
Symbol Shape	Drop down menu: select the shape of the ideal constellation symbols for all constellation displays. The default selection is Filled Boxes. Open Circles Filled Circles Crosses Diagonal Crosses Vertical Lines Horizontal Lines Boxes Filled Boxes Open Diamonds Filled Diamonds Dots None
Symbol Size	Sets the display size of the symbol shape for all EVM displays. The default setting is 2. The range is 0 to 500.
RMS Plot Only	Drop down menu: select True or False. If True is selected, only the RMS line in the EVM vs Symbol and EVM vs Subcarriers will be plotted, and the symbol points will be omitted.

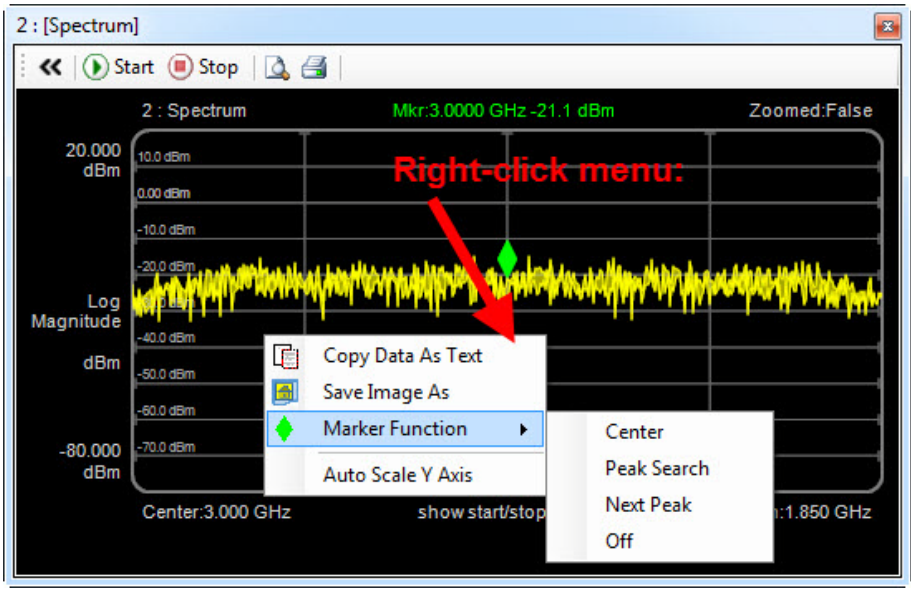
Setting	Description
General Display Settings:	
Display Quality	Drop down menu: select High Quality (slower) | Medium Quality | Low Quality (faster) Select the level of display quality. Switching to a lower quality may speed up the display.
Spectrum/Main Time Displays:	
Draw Min/Max Lines	Drop down menu: select True (the default selection) or False. If True is selected, a solid line is draw which shows the minimum and maximum values in the trace data.
Fill Min/Max	Drop down menu: select True (the default selection) of False. If True is selected, the region bound by the minimum and maximum values in the trace data is filled.
Draw All Points	Drop down menu: select True or False. (False is the default setting.) If True is selected, every data point in the trace is shown. This can reveal subtle behaviors in the data, but will slow down the display.
Auto Scale after Auto-Range	Drop down menu: select True or False. (False is the default setting.) If True is selected, the Y-axis is adjusted as part of the Auto-Range operation.
Sub-Carrier Displays:	
Reverse Sub-Carrier Axes	Drop down menu: select True or False. (False is the default setting.) If True is selected, measurement displays with sub-carrier based x-axes will be reversed and go from positive to negative.
Text Displays	
Auto Grow Text Displays	Drop down menu: select True (the default setting) or False. If True is selected, text displays expand to fit the current window size.
Auto Shrink Text Displays	Drop down menu: select True or False. (False is the default setting.) If True is selected, text displays shrink to fit the current window size.

Spectrum

The **Spectrum** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied n text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Marker Function** (select **Center**, **Peak Search**, **Next Peak**, or **Off**).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal). To set a specific range, see ":DISPlay: Commands" on page 160.

Figure 2-35 Spectrum window

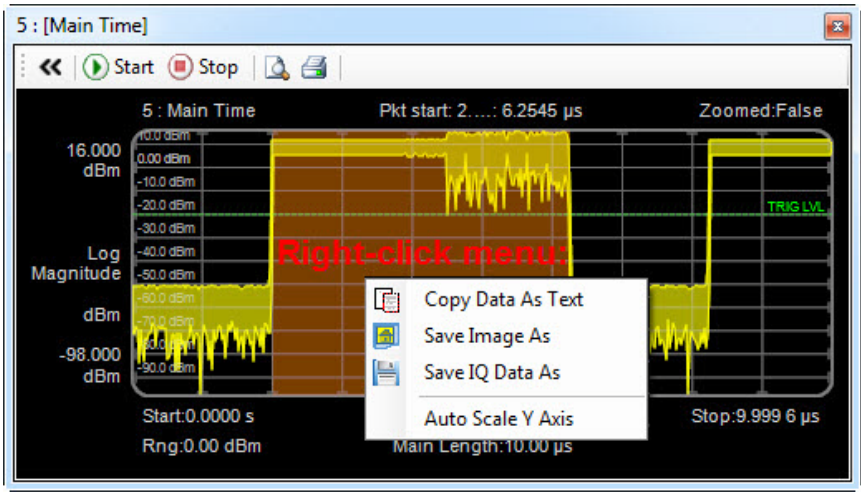


Main Time

The **Main Time** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Save IQ Data As** (save the time record as IQ pairs in the .csv file format). The saved data can be analyzed via the **File > Open Recording** selection. This feature requires license E7760A-RFP.
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-36 Main Time window

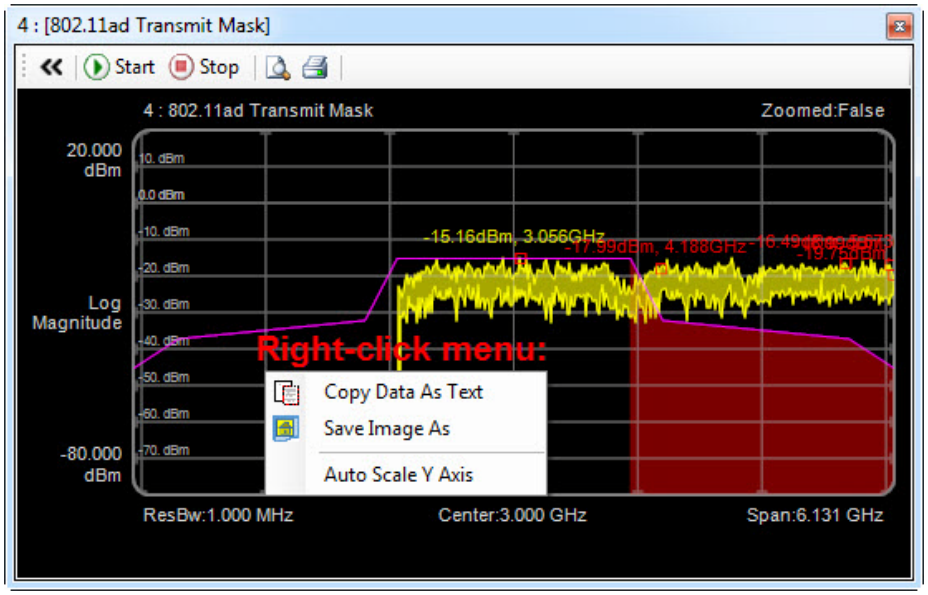


802.11ad Transmit Mask

The **802.11ad Transmit Mask** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal). To set a specific range, see ":DISPlay: Commands" on page 160.

Figure 2-37 802.11ad Transmit Mask window

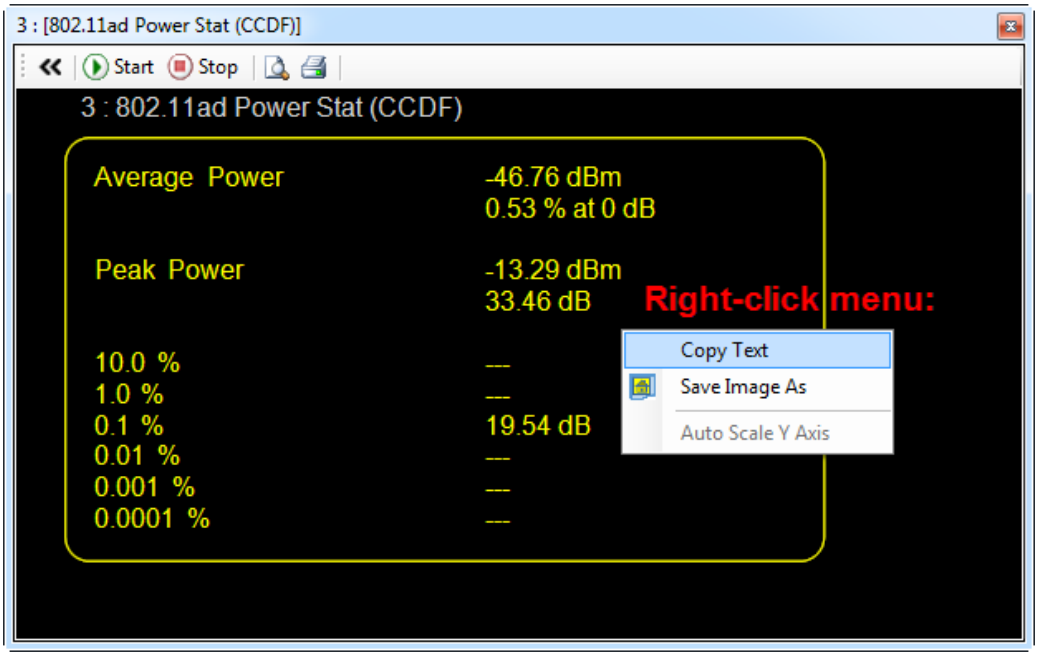


802.11ad Power Stat (CCDF)

The **802.11ad Power Stat (CCDF)** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).

Figure 2-38 802.11ad Power Stat (CCDF)

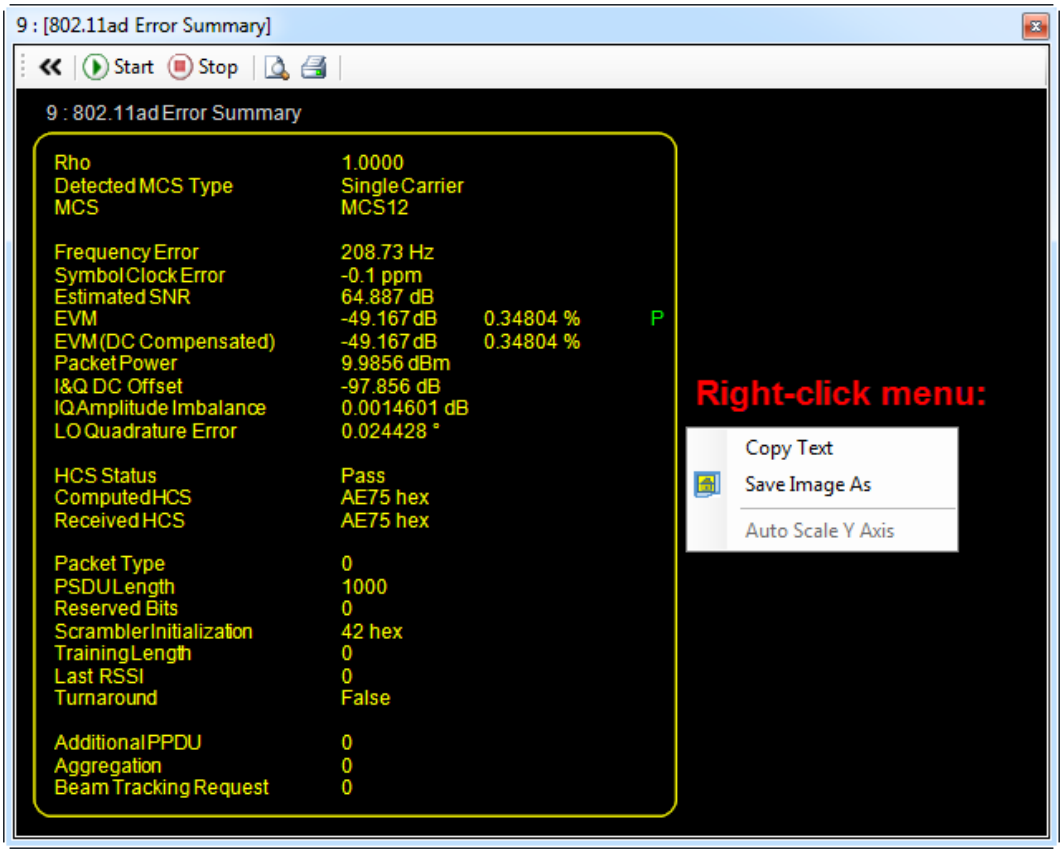


802.11ad Error Summary

The **802.11ad Error Summary** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).

Figure 2-39 802.11ad Error Summary

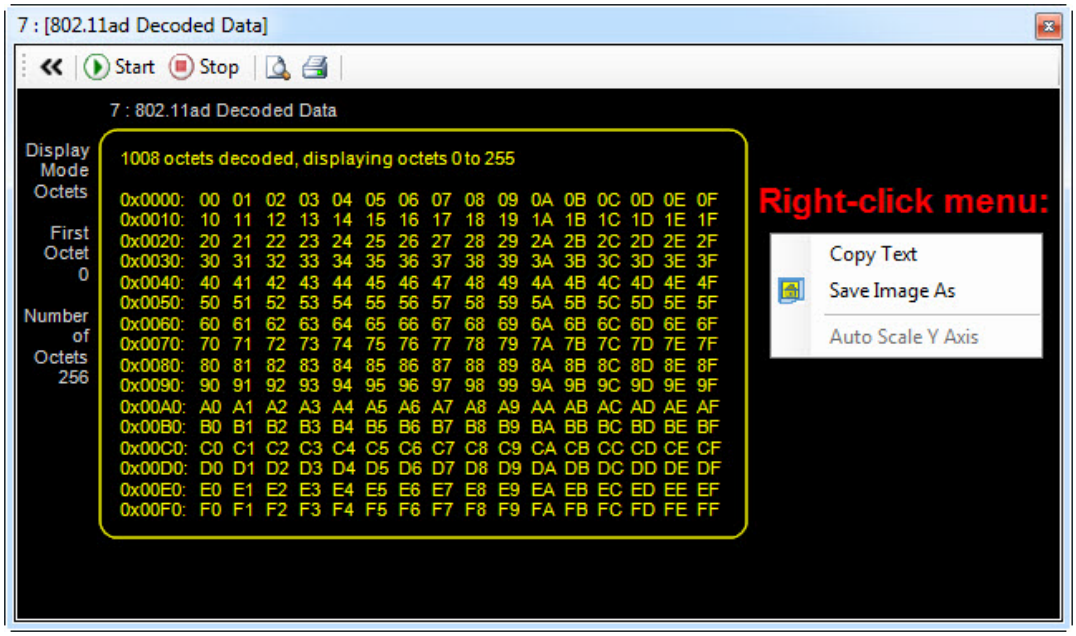


802.11ad Decoded Data

The **802.11ad Decoded Data** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).

Figure 2-40 802.11ad Decoded Data

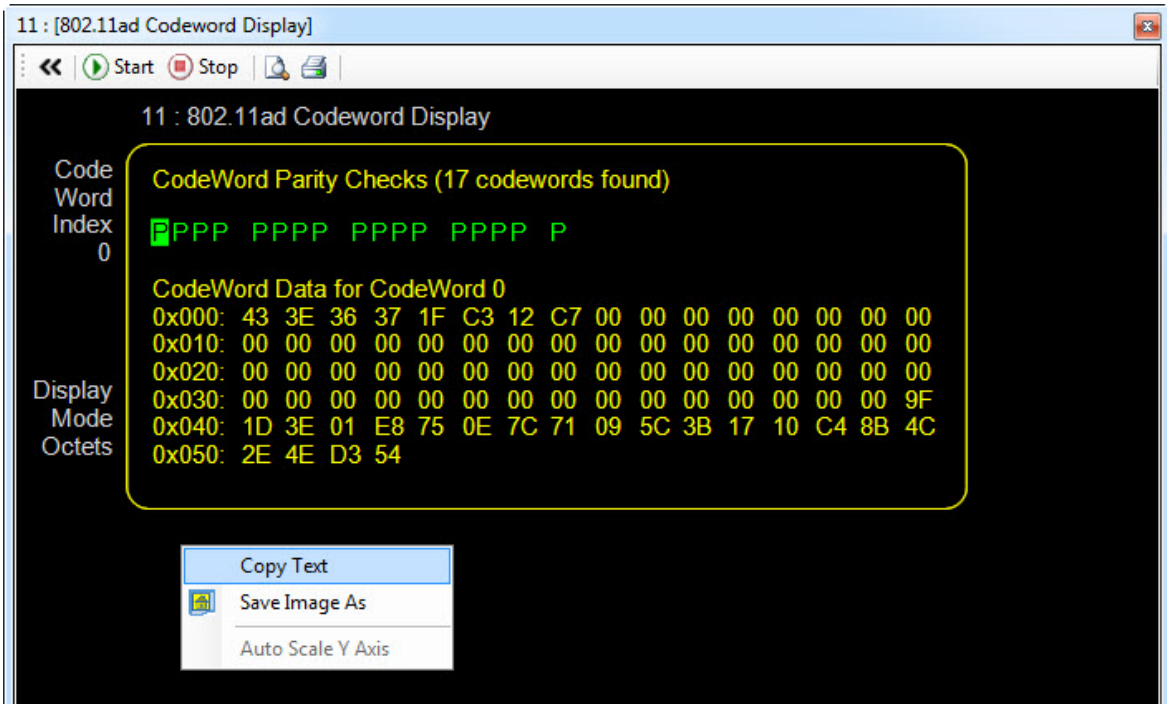


802.11ad Codeword Display

The **802.11ad Codeword Display** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Marker Function** (select **Center**, **Peak Search**, **Next Peak**, or **Off**).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-41 802.11ad Codeword Display window

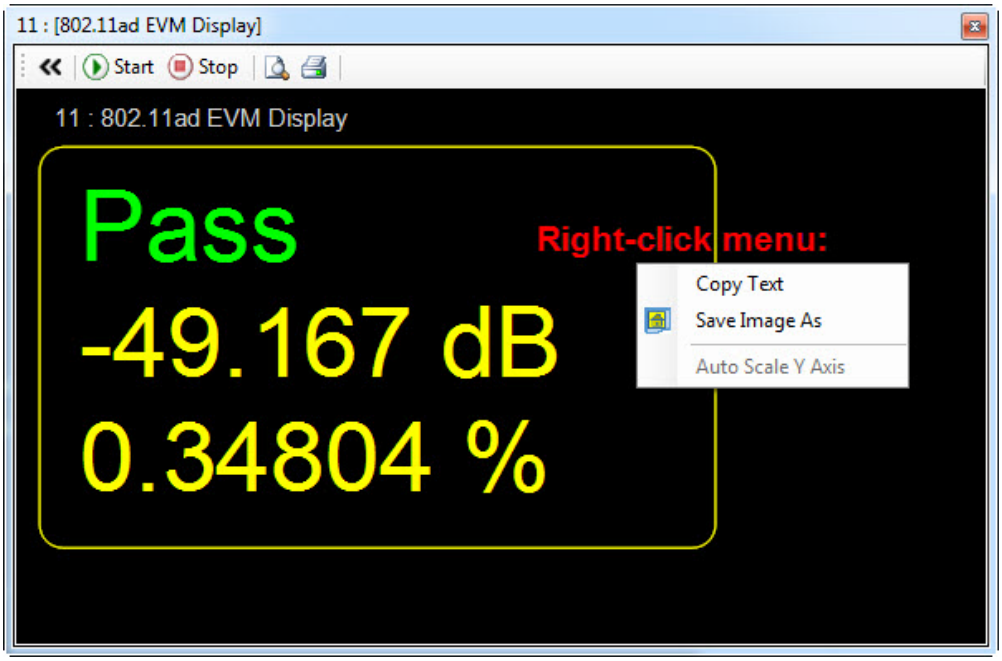


802.11ad EVM Display

The **802.11ad EVM Display** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).

Figure 2-42 802.11ad EVM Display window

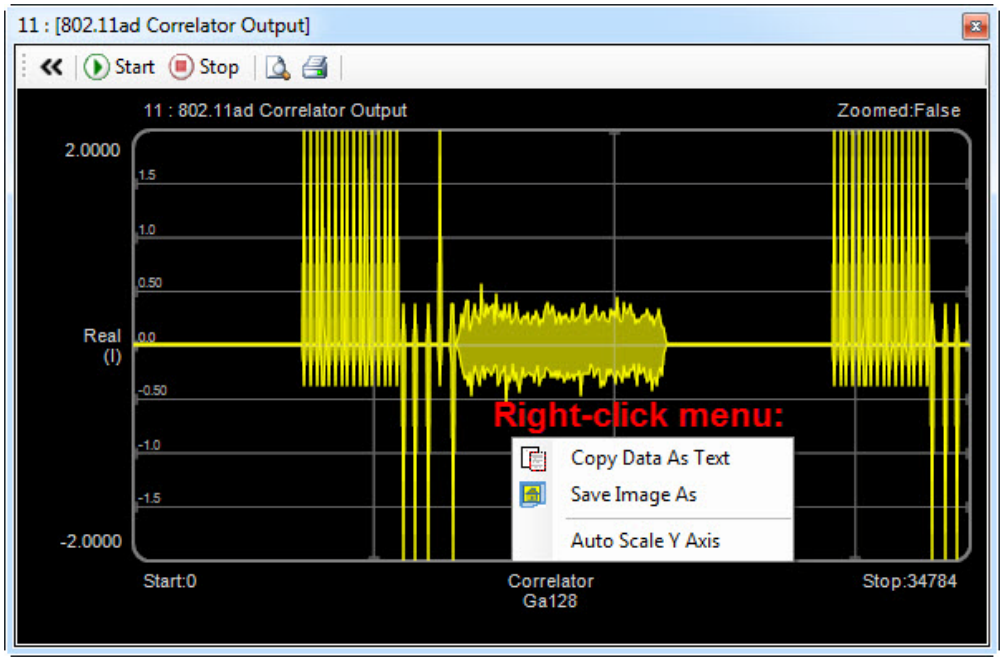


802.11ad Correlator Output

The **802.11ad Correlator Output** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-43 802.11ad Correlator Output

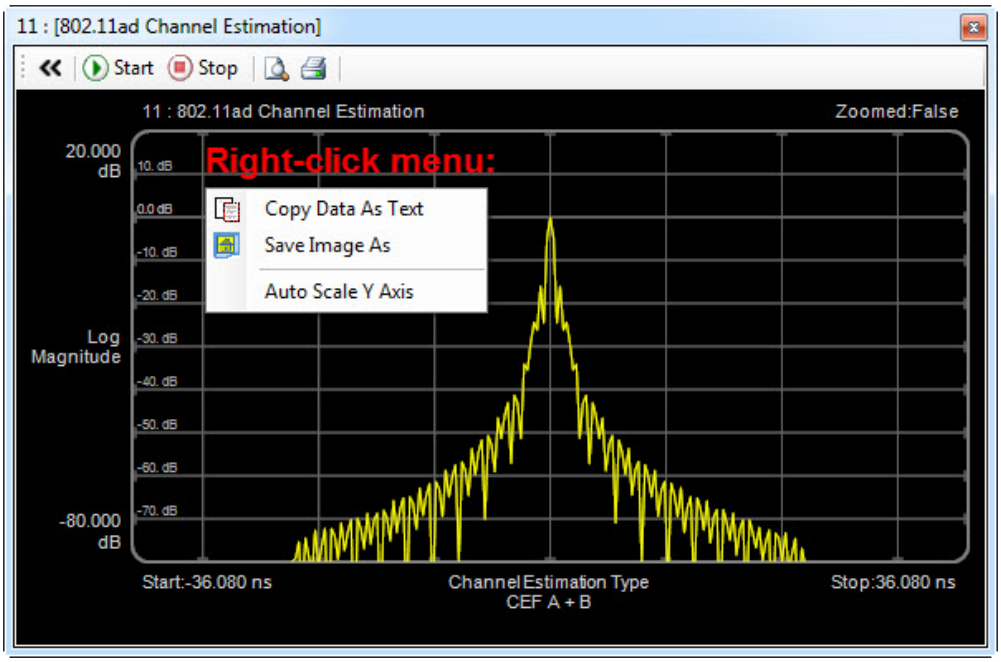


802.11ad Channel Estimation

The **802.11ad Channel Estimation** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-44 802.11ad Channel Estimation window

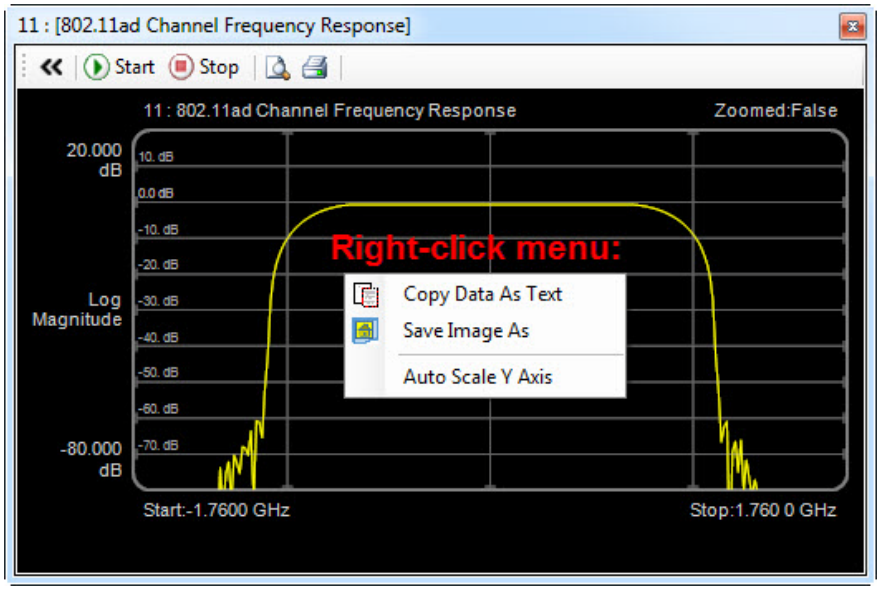


802.11ad Channel Frequency Response

The **802.11ad Channel Frequency Response** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied n text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-45 802.11ad Chanel Frequency Response window

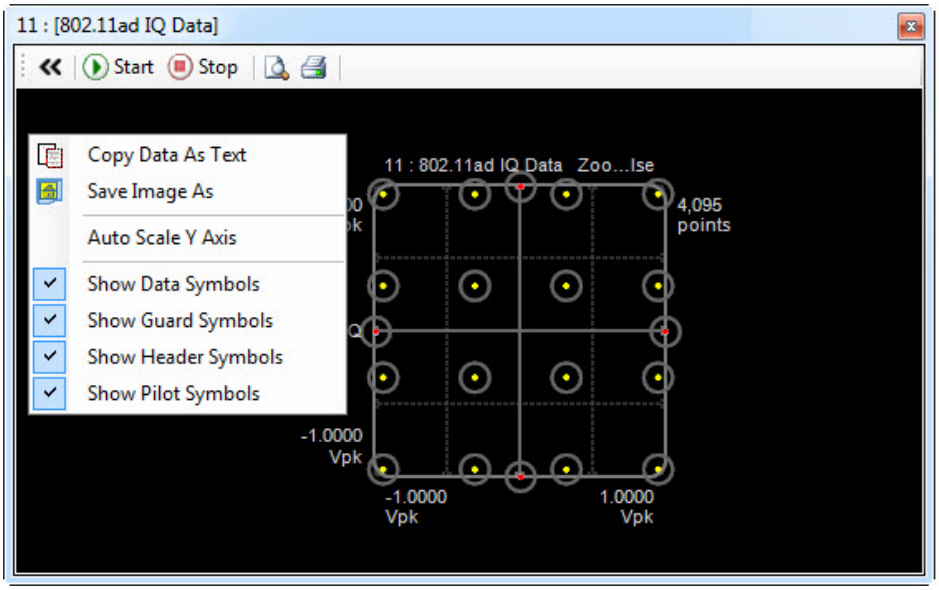


802.11ad IQ Data

The **802.11ad IQ Data** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).
- **Show Data Symbols**, **Show Guard Symbols**, **Show Header Symbols**, and **Show Pilot Symbols** (check or uncheck the boxes to show or hide these elements of the display)

Figure 2-46 802.11ad IQ Data window

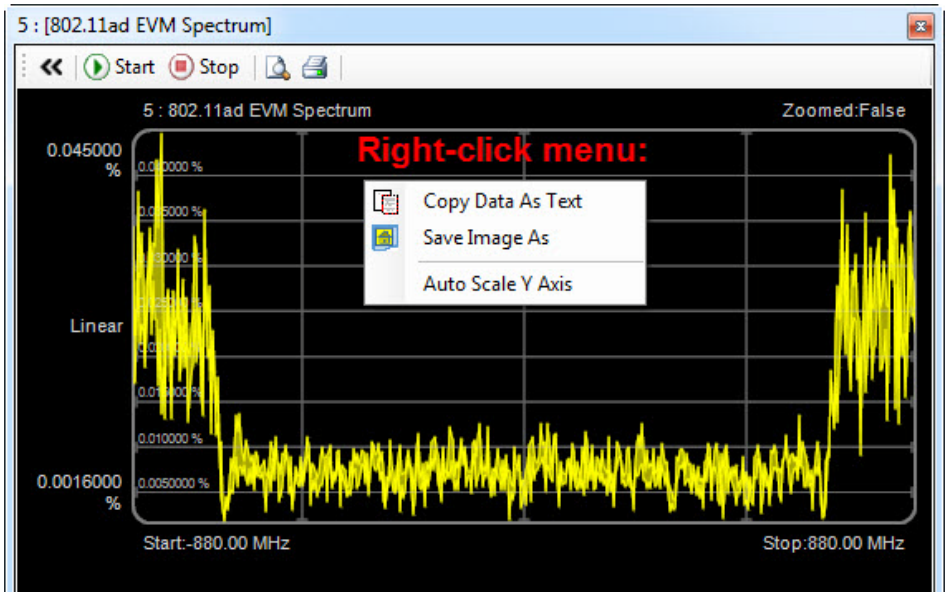


802.11ad EVM Spectrum

The **802.11ad EVM Spectrum** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied n text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-47 802.11ad EVM Spectrum window

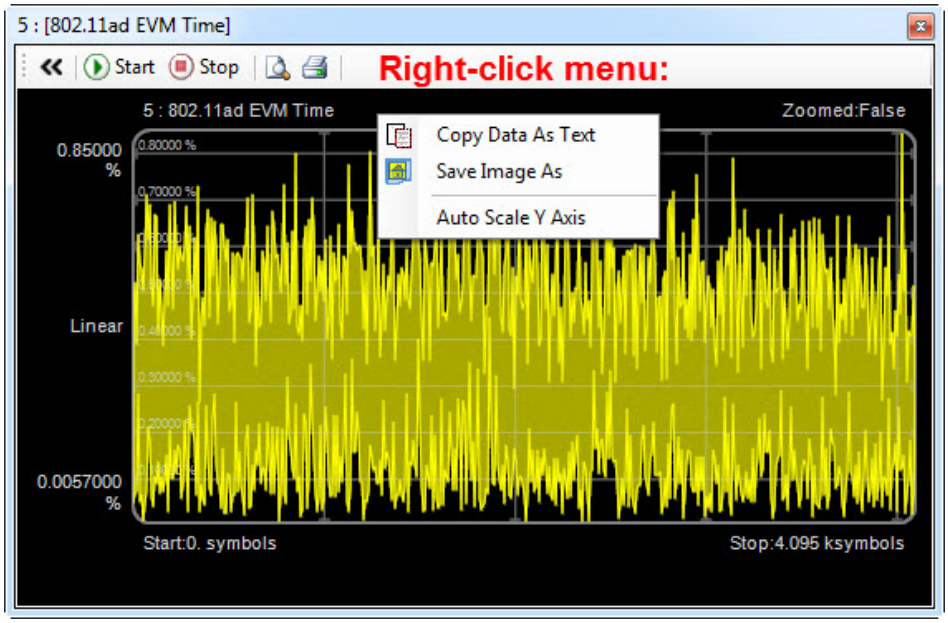


802.11ad EVM Time

The **802.11ad EVM Time** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-48 802.11ad EVM Time window

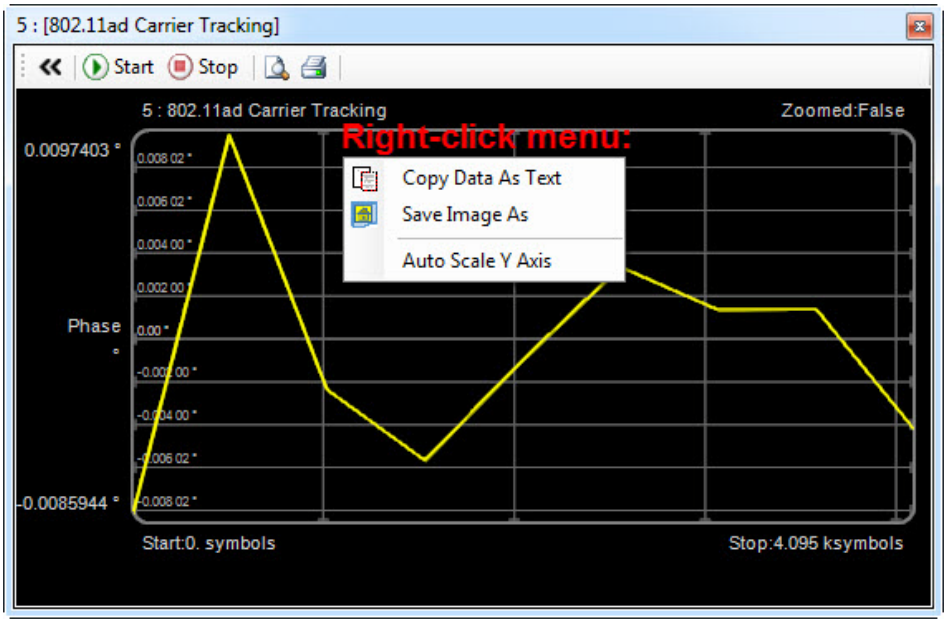


802.11ad Carrier Tracking

The **802.11ad Carrier Tracking** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied in text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-49 802.11ad Carrier Tracking window

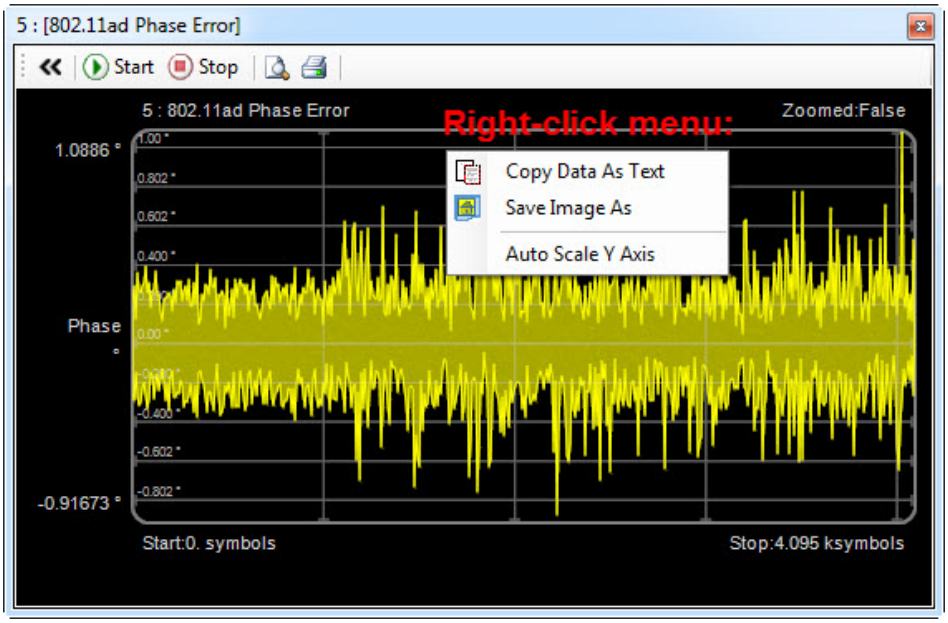


802.11ad Phase Error

The **802.11ad Phase Error** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

- **Copy Data As Text** (the measured data is copied n text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-50 802.11ad Phase Error window

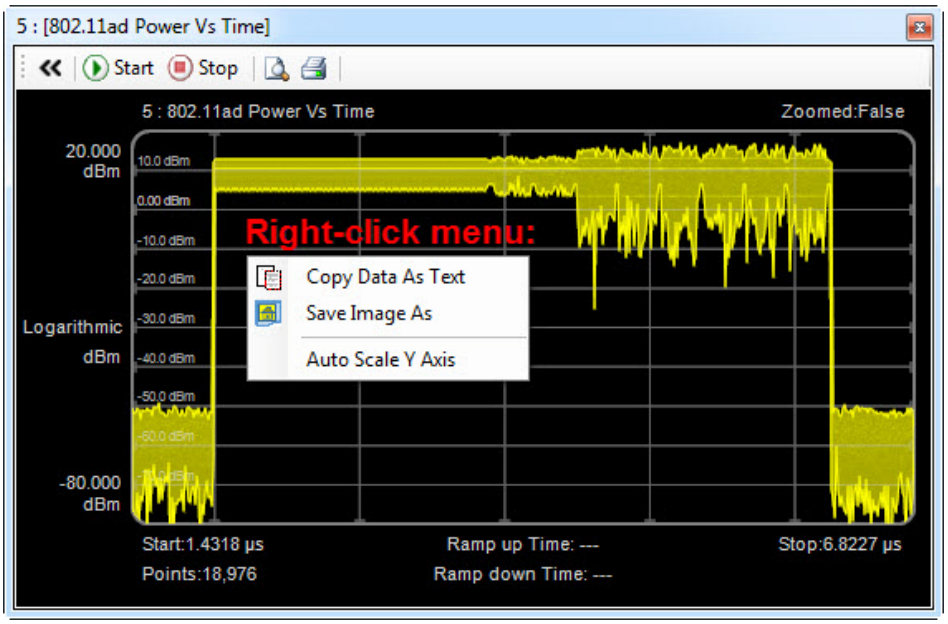


802.11ad Power vs Time

The **802.11ad Power vs Time** measurement display window duplicates the **Start**, **Stop**, **Print Preview**, and **Print** icons from the toolbar. A right-click menu on the title bar makes it possible to select a different measurement for this window. In addition, a right-click menu within the display itself provides the following capabilities:

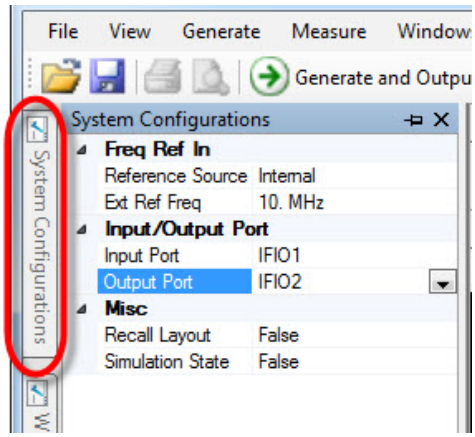
- **Copy Data As Text** (the measured data is copied n text form to the clipboard; the information can then be pasted into any kind of text editor).
- **Save Image As** (save a screen-capture image of the measurement display to a file in `.png` format).
- **Auto-Scale Y Axis** (adjust the vertical range to encompass the measured range of the signal).

Figure 2-51 802.11ad Power vs Time window

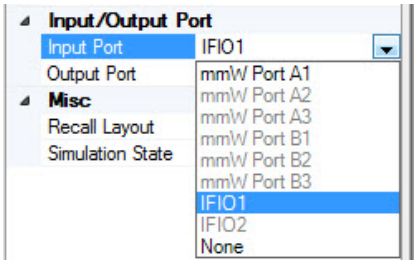


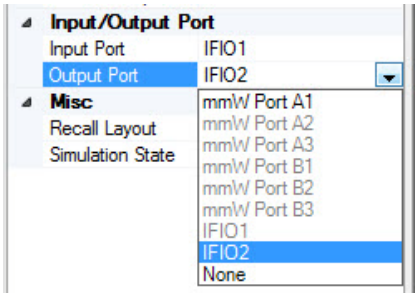
System Configurations

Figure 2-52 System Configurations window



The settings are described in the following table.

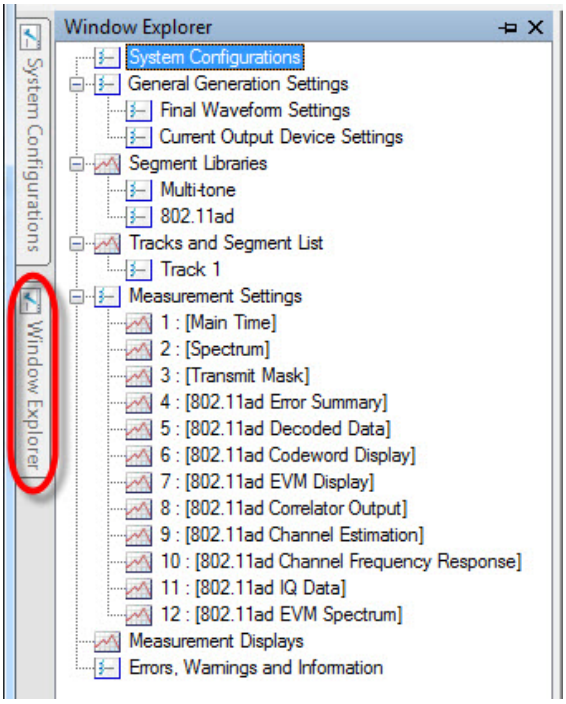
Setting	Description
Freq Ref In:	
Reference Source	Select the frequency reference as being the Internal reference or an External input received at the connector labeled 10 MHz IN on the rear panel. When the frequency reference is set to Internal, the internal 10 MHz reference is used even if an external reference is connected at the rear panel. See SCPI command `:SENSe:ROSCillator:SOURce:TYPE`
Ext Ref Freq	Specifies the frequency of the external reference. When the external reference is in use (see the Reference Source setting above), this information is used by the instrument to make 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 input frequency. Permissible values for this are 10, 20, 30, 40, or 50 MHz. See SCPI command `:SENSe:ROSCillator:EXTernal:FREQuency`
Input/Output Port:	
Input Port	Drop down menu: select the signal input port:  The available selections for the Input Port are limited by other settings; see “Port Rules (mmWave Ports)” on page 138 and “Port Rules (IO Ports)” on page 140. See SCPI command `:SENSe:FEED:PORT[:INPut]`

Setting	Description
Output Port	Drop down menu: select the signal output port:  The available selections for the Input Port are limited by other settings; see "Port Rules (mmWave Ports)" on page 138 and "Port Rules (IO Ports)" on page 140. See SCPI command `:SENSe:FEED:PORT:OUTPut`.
Misc In:	
Recall Layout	Drop down menu: select True | False. Enable or disable Recall Layout mode. In this mode, selecting **File > Recall State** will recall the entire layout of windows within the display, not just the source and measurement settings. Recalling a state in this mode takes a little longer. See SCPI command `:SYSTem:APPLication:RECall:LAYout`
Simulation State	Drop down menu: select True | False. Enable or disable the simulation state of the system. (In the simulation state, artificial data is displayed; this can be useful in configuring a measurement when actual data is not yet available.) See SCPI command `:SYSTem:APPLication:SIMulation[:STATe]`

Windows Explorer

This window shows an outline of all the windows in the interface, including some which may not be currently visible (because they are on a tabbed window display and are not currently highlighted). Clicking on the name of a window which is obstructed from view in this way will bring it forward.

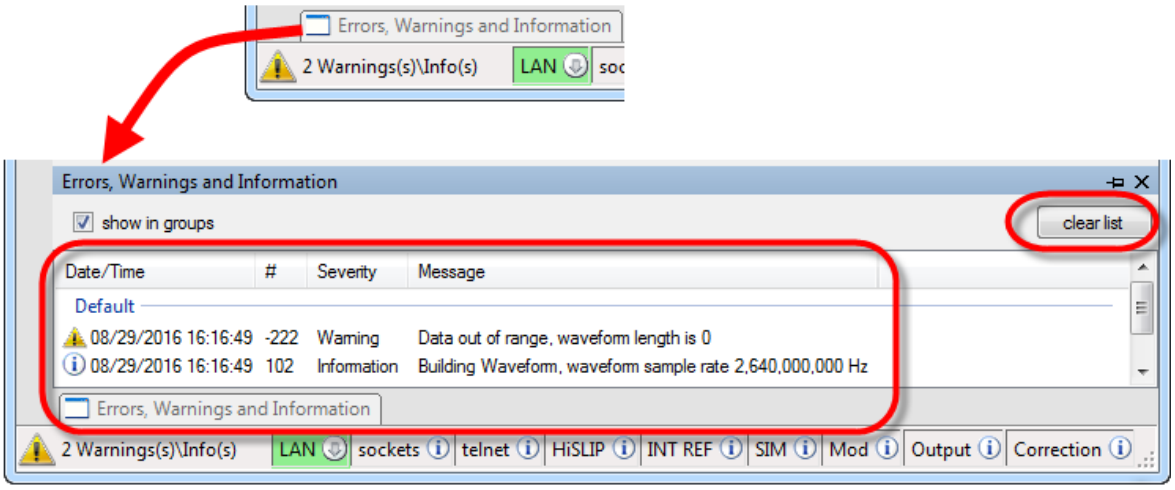
Figure 2-53 Windows Explorer windows



Messages & status indicators

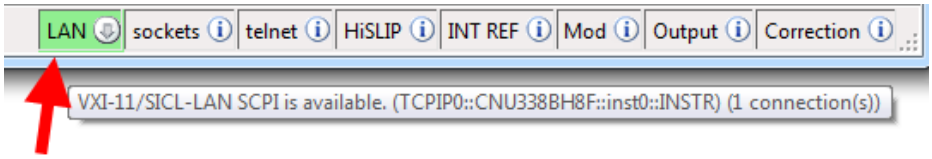
A notice appears at the lower left corner of the application window whenever the **Errors, Warnings, and Information** tab contains any messages. Click on the tab to make these messages visible. (Click the **clear list** button to delete the displayed message.)

Figure 2-54 Errors, Warnings, and Information



The row of status indicators at the bottom of the display provides information about the current status of the instrument (for example, that the LAN connection is active, in the illustration below).

Figure 2-55 Status indicators



The other indicators show whether **Socket** SCPI, **Telnet** SCPI, or **HiSLIP** SCPI is available and has a connection; whether the frequency reference is set to **Internal** or **External**, and what the on/off status is for **Modulation**, **Output**, and **Correction**.

3 Purpose and Function

The following topics can be found in this section:

Introduction

The E7760A Wideband Transceiver is a test set which generates and measures 802.11ad signals.

The E7760A features two IFIO ports (2-18 GHz) and six mmWave ports (55-68 GHz). The mmWave ports are designed to connect with the M1650A mmWave Transceiver, a test head which is purchased separately from the E7760A.

The photo below shows the E7760A connected to an M1650A mmWave transceiver, a monitor, a keyboard, and a mouse.

Figure 3-1 E7760A and accessories

Radio Standard: IEEE 802.11ad-2012 PHY

Introduction

This section provides a brief summary of the mmWave PHY layer defined in clause 21 of the IEEE 802.11ad-2012 amendment to IEEE Std. 802.11™-2012. To maintain generality in the specification text, and to simplify functional descriptions in future, the IEEE has introduced new terminology to identify the higher performance PHYs;.

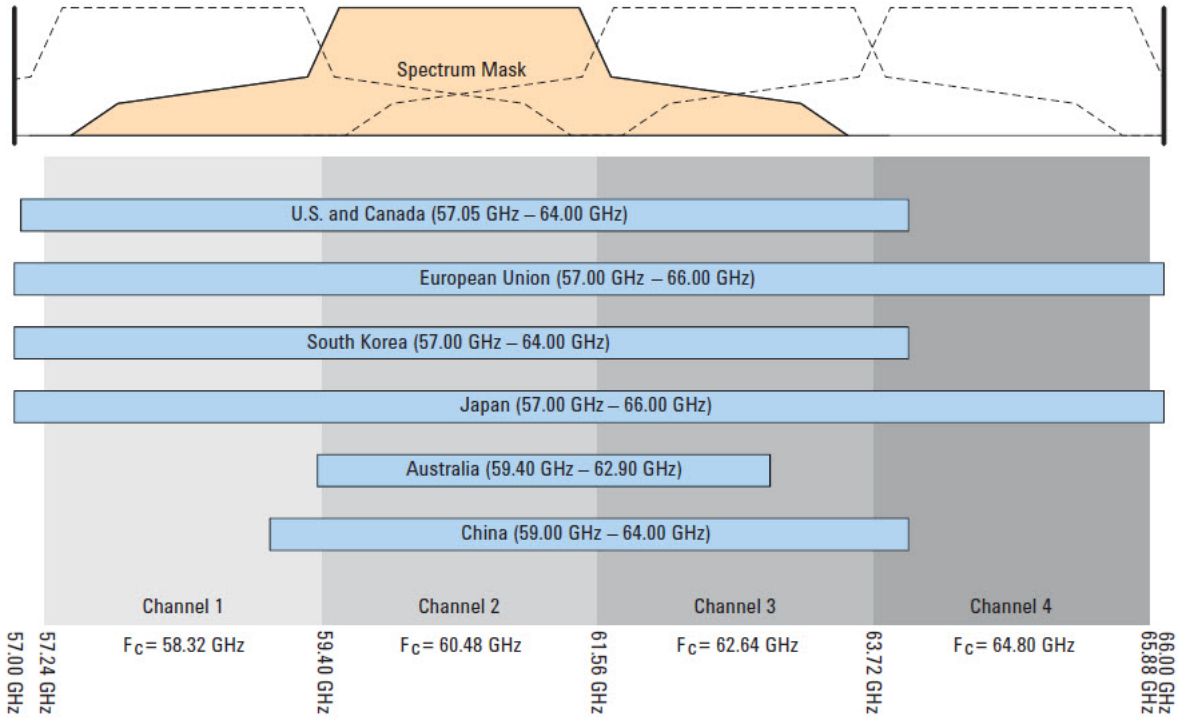
– VHT, which is short for very high throughput, is any frequency band that has a starting frequency below 6 GHz excluding the 2.4 GHz band.

– DMG, which is short for directional multi-gigabit, pertains to operation in any frequency band that contains a channel with a channel starting frequency above 45 GHz.

These terms replace the previous, more frequency-specific terms LB (Low Band at 2.4GHz), HB (High Band at 5GHz), and UB (Ultra Band at 60GHz).

So, using the new terminology, clause 21 of IEEE 802.11ad-2012 defines the DMG PHY, which is normally deployed in the “60 GHz” band from 57 GHz to 66 GHz; subject to the regional variations shown in Figure 3-2 below.

Figure 3-2 60 GHz band channel plan and regional frequency allocations



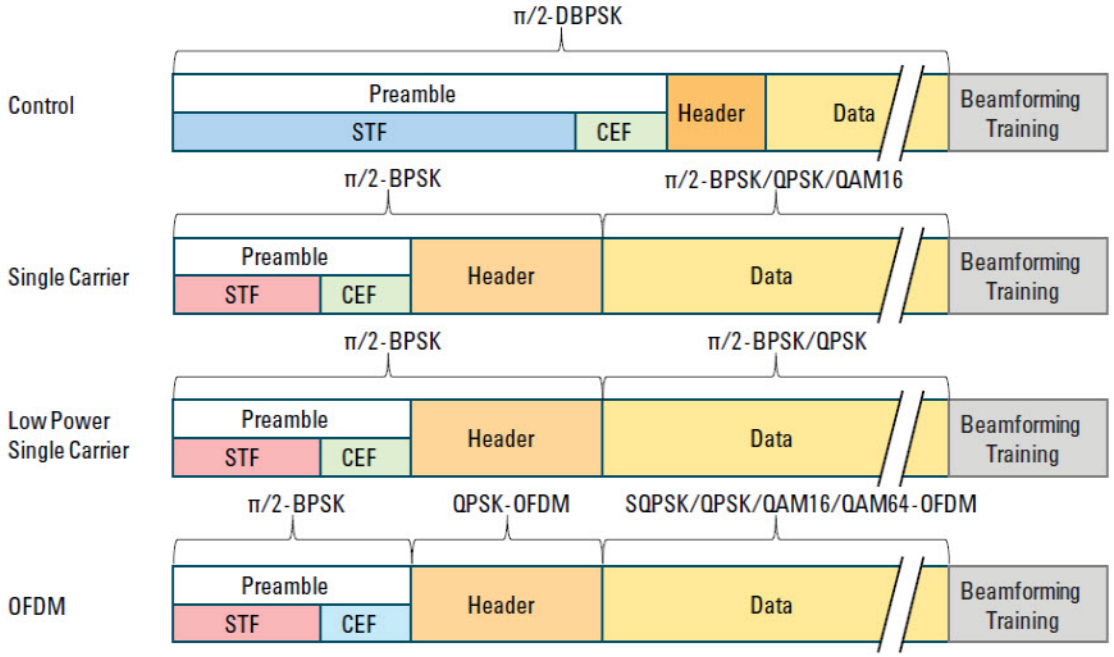
Packet Structure

The IEEE 802.11ad-2012 DMG PHY supports three distinct modulation methods:

- Spread-spectrum modulation; the Control PHY.
- Single carrier (SC) modulation; the Single Carrier PHY and the Low Power Single Carrier PHY.
- Orthogonal Frequency Division Multiplex (OFDM) modulation; the OFDM PHY.

Each PHY type has a distinct purpose and packet structure, shown in Figure 4, but care has been taken to align the packet structures, and in particular the preambles, to simplify signal acquisition, processing and PHY type identification in the receiver.

Figure 3-3 Packet structure for each modulation type

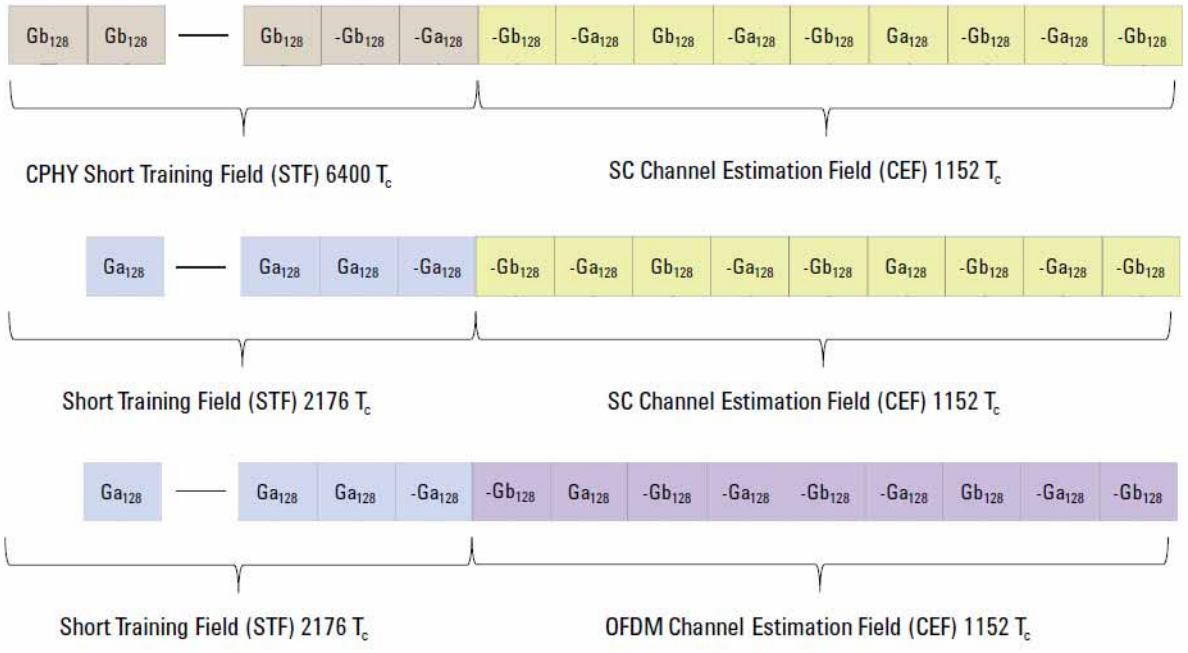


Preamble

The three packet types share an essentially common preamble structure comprising a Short Training Field (STF) followed by a Channel Estimation Field (CEF). These fields are constructed from p/2-BPSK modulated repeating Golay sequences (see "Golay Complementary Sequences" on page 116).

Figure 3-4 shows the structure of the three different preamble types in more detail, illustrating that the basic building blocks are the Golay complementary sequences Ga_{128} and Gb_{128}.

Figure 3-4 Preamble variants (Ga128 and Gb128 sequences)



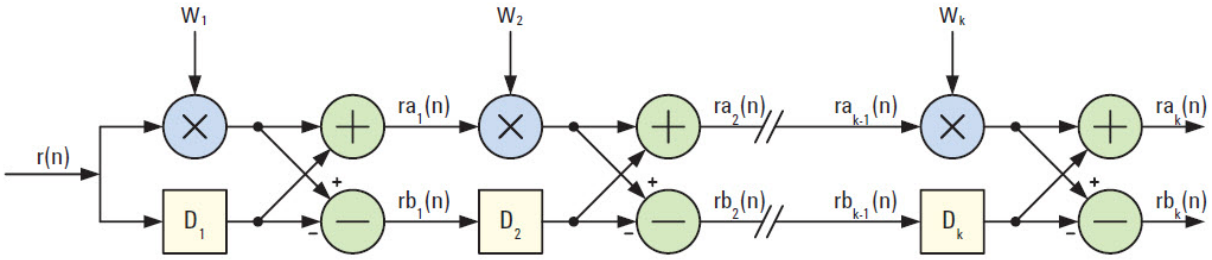
Golay Complementary Sequences

Three important attributes of Golay complementary sequences are,

1. The autocorrelation of each sequence has low false peaks and low DC content under $\pi/2$ rotation.
2. The sum of the very good but imperfect autocorrelation functions of the Ga and Gb sequences is perfect (the false peaks cancel exactly).
3. The Ga and Gb autocorrelations can be performed in parallel using a single, hardware efficient (and therefore fast) correlator.

A suitable fast correlator architecture is illustrated generically in Figure 3-5.

Figure 3-5 Fast Correlator Architecture



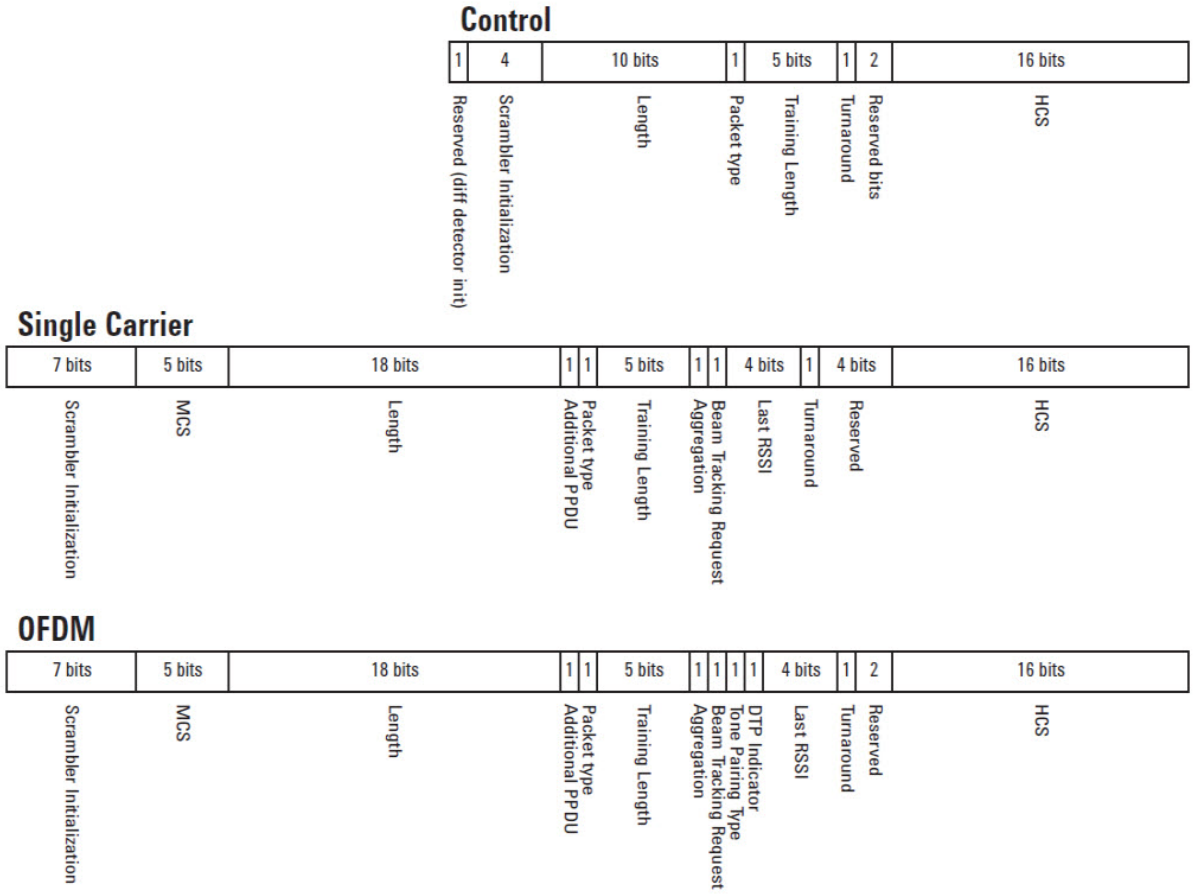
Header

In all cases the preamble is followed by a header field that conveys information about the rest of the packet. Most importantly it signals the Modulation and Coding Scheme (MCS) being used for the payload part of the packet.

The information encoded in the header is very similar for Single Carrier and OFDM packets, except that the OFDM header defines a couple of additional OFDM-specific fields; the Tone Pairing Type and Dynamic Tone Pairing (DTP) Indicator flags.

The Control packet header is an abbreviated but otherwise consistent version of the standard header. The header field structures are illustrated in Figure 3-6.

Figure 3-6 Header Structure



Some of the more important header fields are:

- **Scrambler Initialization:** This field seeds the scrambler which is applied to the remainder of the header and the payload for data whitening purposes.
- **MCS:** This field indicates the modulation and coding scheme employed in the payload part of the packet.
- **Length:** This field indicates the number of octets of data in the payload.
- **Training Length:** This field indicates the length of the optional beam forming training field at the end of the packet.
- **Packet Type:** This flag indicates whether the optional beam forming training field is configured for transmitter or receiver training.
- **HCS:** This is a CRC-32 checksum over the header bits.

Payload

The packet payload content is a stream of octets. As mentioned, the header Length field quantifies the useful content of the payload. Prior to encoding, the payload data, depending on the chosen length, may be extended by a small amount, using “stuffing bits”, so that the encoding process will produce a whole number of modulation blocks or symbols. These dummy data are discarded by the decoding process.

The specification tabulates 32 different modulation and coding schemes. However, as we have seen in the preceding paragraphs, there are just a few variations in the modulation and encoding of the preamble and header fields across all 32 MCS.

The packet type, and therefore the modulation of the header field is signalled by modest variations in the preamble’s fields; the use of Gb_{128} rather than Ga_{128} sequences in the STF signals a Control packet, while the ordering of the Gu_{512} and Gv_{512} fields in the CEF signals whether this is an SC or OFDM packet.t

Thus we can quickly simplify the picture by dividing the MCS list into four basic classifications, as illustrated in Figure 3-7.

Figure 3-7 Modulation and Coding Scheme (MCS)

Control (CPHY)		
Coding	Modulation	Raw Bit Rate
Shortened 3/4 LDPC, 32x Spreading	π/2-DBPSK	27.5 Mbps
Single Carrier (SCPHY)		
Coding	Modulation	Raw Bit Rate
1/2 LDPC, 2x repetition 1/2 LDPC, 5/8 LDPC 3/4 LDPC 13/16 LDPC	π/2-BPSK, π/2-QPSK, π/2-16QAM	385 Mbps to 4620 Mbps
Orthogonal Frequency Division Multiplex (OFDMPHY)		
Coding	Modulation	Raw Bit Rate
1/2 LDPC, 5/8 LDPC 3/4 LDPC 13/16 LDPC	OFDM-SQPSK OFDM-QPSK (DCM) OFDM-16QAM OFDM-64QAM	693 Mbps to 6756.75 Mbps
Low-Power Single Carrier (LPSCPHY)		
Coding	Modulation	Raw Bit Rate
RS(224,208) + Block Code(16/12/9/8,8)	π/2-BPSK, π/2-QPSK	625.6 Mbps to 2503 Mbps

Figure 3-7 on page 119 illustrates the underlying order and purpose in such an apparently large choice of MCS.

It is clearly important, for the reliable establishment and maintenance of connectivity, that the control channel should be as robust as possible. The purpose of the control PHY, and the reasons for its emphasis on reliability over raw speed are considered evident.

It is perhaps less clear why so many MCS are required.

Given the anticipated diversity of device type that will want to support 802.11ad, there are persuasive arguments for and against both OFDM and Single Carrier based modulations, and for seriously constrained devices there is a further argument in favor of trading the strength of LDPC-based error correction for further power savings.

Within each of the SC, OFDM and LPSC categories, the specific MCS selects a different pairing of error protection coding and modulation depth, which taken together provide the user with a logical progression of link quality versus throughput operating points.

Control PHY

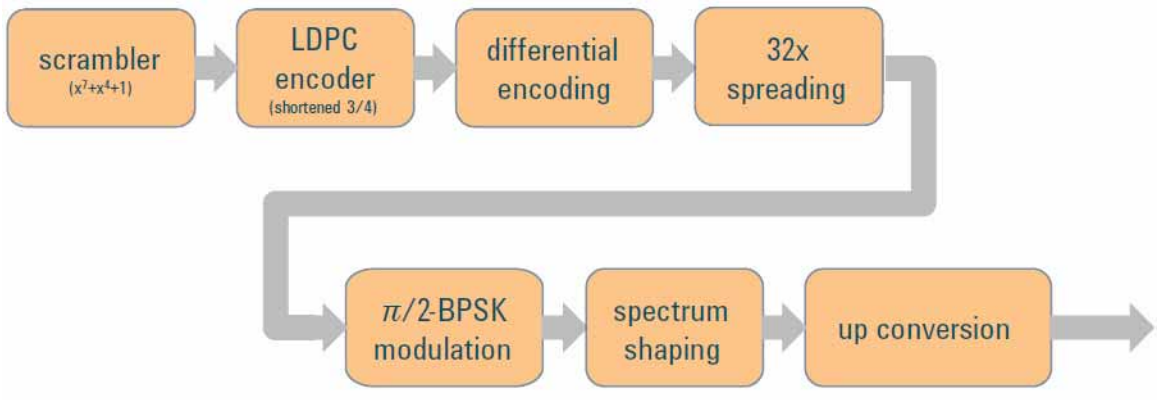
Modulation and Coding Scheme 0 (MCS0) is by far the most robustly coded (and consequently, lowest throughput) mode. Its purpose is exclusively to transmit control channel messages and it is referred to as the Control PHY (CPHY). Support for MCS0 is mandatory.

The CPHY robustness is evident from its use of differential encoding, code spreading and BPSK modulation. Differential encoding eliminates the need for carrier tracking, 32x spreading contributes a theoretical 15 dB gain to the link budget, and BPSK is, of course, very noise tolerant.

A Ga_{32} Golay complementary code is used as the spreading code, so we can see the result of the despreading process directly by looking at the Ga_{32} correlator output.

Comment with reference to figure in Figure 3-5.

Figure 3-8 Summary block diagram of CPHY coding/modulation steps

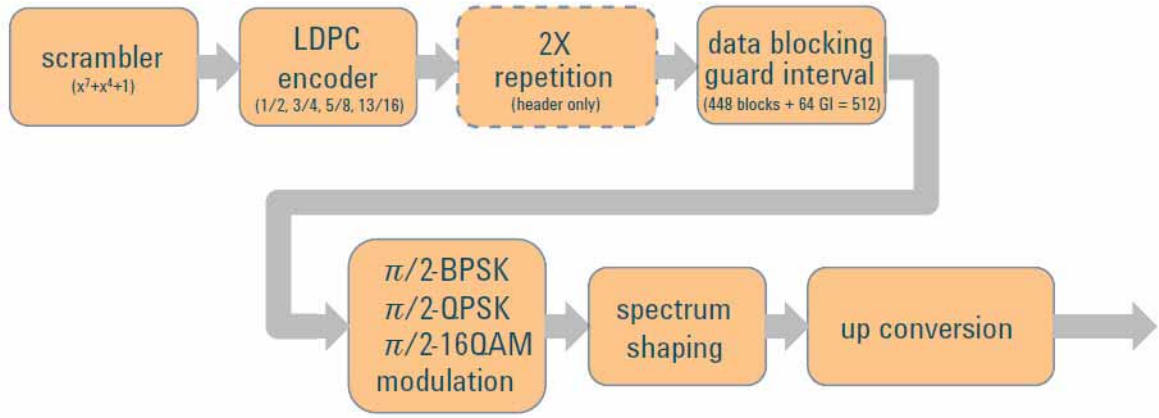


Single Carrier PHY

Modulation and Coding Schemes 1 through 12 (MCS1 – MCS12) employ single-carrier modulation; specifically BPSK, QPSK or 16-QAM modulation of a (suppressed) carrier at the channel center frequency, at a fixed symbol rate of 1.76 Gsym/s. All 12 modes are essentially identical in their channel encoding steps, they differ only in the choice of error protection ratio and modulation density, to allow the appropriate tradeoff between throughput and robustness to be determined operationally (by mode selection). These 12 modes are collectively referred to as the Single Carrier PHY (SCPHY). Support for modes MCS1 to MCS4 is mandatory, to ensure that all compliant devices are capable of data interchange at rates in excess of 1Gbps as required by the original TGad PAR.

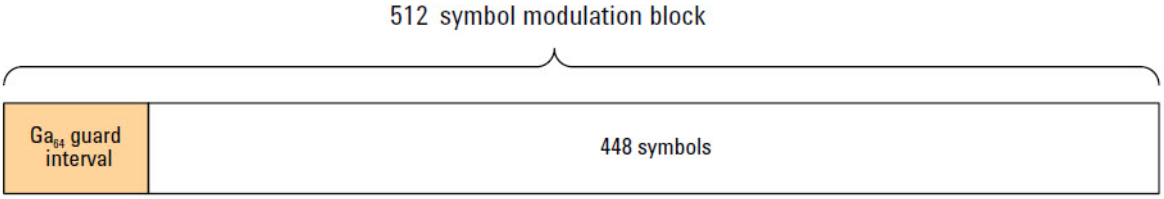
The Low-Density Parity Check (LDPC) error correcting coding technique that is common to the CPHY, SCPHY and OFDMPHY MCS is based on a common codeword length of 672 bits each carrying either 336, 504, 420 or 546 payload bits to achieve rate 1/2, 3/4, 5/8 or 13/16 as required.

Figure 3-9 Summary block diagram of SCPHY coding/modulation steps



The LDPC code employs a Cyclic Shifted Identity (CSI) construction based on a submatrix size of 42 and was designed to permit very efficient encoding using back substitution, and decoding using either fully parallel or layered decoding techniques.

Figure 3-10 SCPHY payload modulation block



The data blocking and guard interval divides the modulation symbols into groups of 448 symbols interspersed with 64 symbol “Golay sequence guard intervals” (GI) that provide the receiver with a periodic known reference signal to assist with gain and phase tracking. The 64 symbol guard interval is a Ga_{64} Golay sequence and its periodic occurrence can be confirmed by examining the output of the Ga_{64} correlator.

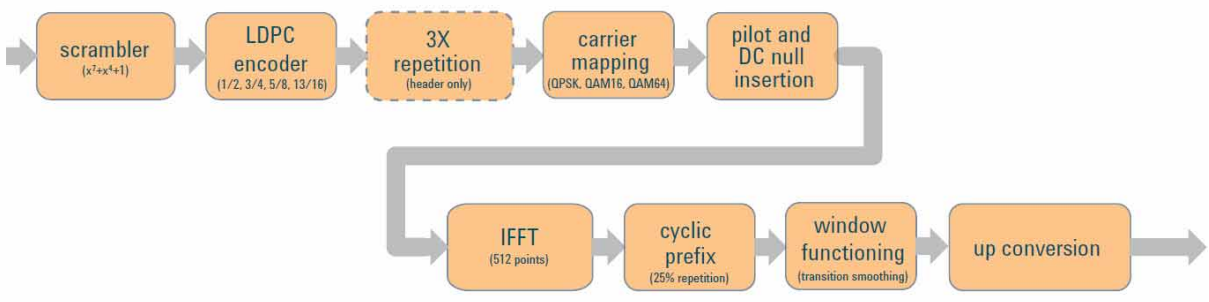
The modulation is very conventional single-carrier modulation which is p/2 rotated to minimize the peak to average power ratio (PAPR) of the BPSK modulation (the GI’s are always BPSK modulated) and to allow equivalent GMSK modulation. reference to figure in .

Spectrum shaping is mandated but the details are not specified, to permit some design freedom.

OFDM PHY

Modulation and Coding Schemes 13 through 24 (MCS13 – MCS24) employ multi-carrier modulation; specifically Orthogonal Frequency Division Multiplex (OFDM) modulation, which can provide higher modulation densities and hence higher data throughput than the single carrier modes. As for the single carrier modes, all 12 OFDM modes have near identical encoding, varying only in choice of error protection ratio and the depth of modulation applied to the OFDM data carriers, again to provide operational control over the robustness/throughput trade-off. Support for OFDM modulation is not required by the specification, but if it is implemented, then MCS13 to MCS16 are mandatory to ensure some level of interoperability between OFDM-capable devices.

Figure 3-11 Summary block diagram of OFDMPHY coding/modulation steps



With regard to the choice of single carrier or OFDM modulation; the generally accepted reason for favoring one over the other is the relative importance, in a given application, of power consumption (i.e. maximizing battery life) compared with maximizing data throughput.

OFDM modulation has a large and often unpredictable peak to average power ratio (PAPR) which is challenging for a linear power amplifier to accommodate efficiently. On the other hand, single-carrier modulation typically has a low or even unity PAPR, which lends itself to very efficient and battery-friendly power amplification.

Conversely, OFDM has a significant advantage over single carrier modulation in terms of energy per bit and is particularly robust in the presence of multi-path distortion, both of which give it the edge in the data throughput achievable for a given channel.

That said, such distinctions are shifting and eroding all the time as the technologies develop.

The LDPC encoding is identical to that used in the single carrier modes.

The OFDM is based on a 512-point FFT with 336 active data carriers, and 16 fixed pilot tones. The carriers at DC and on either side of DC are nulled to avoid any issues with carrier feed-through and the cyclic prefix is fixed at 25% of the symbol period.

The individual OFDM carrier modulation may be SQPSK, QPSK, QAM16 or QAM64.

SQPSK is Spread QPSK, in this mode, the OFDM carriers are paired and the same data is modulated onto two carriers maximally separated in frequency to improve the modulation's robustness in the presence of selective frequency fading. The idea is that if one carrier is lost to a null the other is unlikely to be affected at the same time. The pairing of tones is normally static, but there is an option to pair them dynamically according to channel conditions, which has been shown to provide additional robustness.

MCS15, 16 and 17 are described as using QPSK but in fact use Dual Carrier Modulation, which is QPSK-like in its performance, but is, nonetheless, a different technique.

Dual carrier modulation also uses frequency diversity to mitigate selective fading, but it does so in a more subtle way than SQPSK.

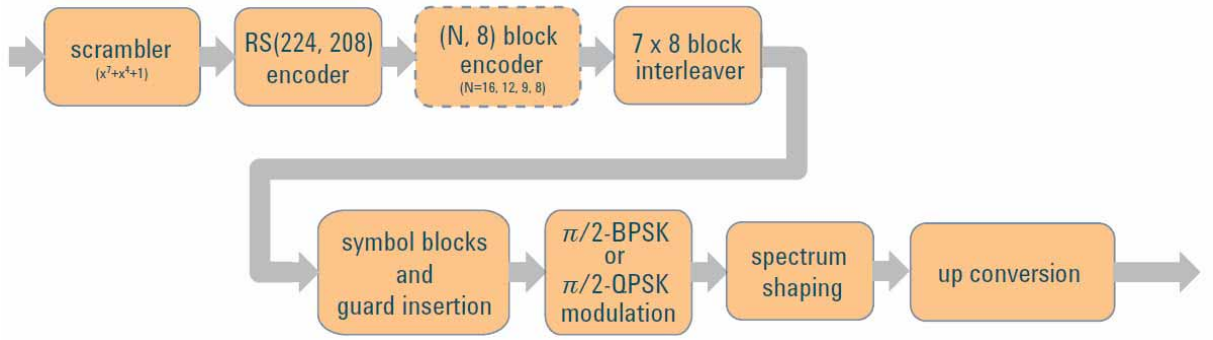
In DCM, four bits of payload data are assigned to two subcarriers, which means that, in terms of "bits per subcarrier" it is similar to QPSK. However, in DCM the state of all four bits determines the amplitude and phase state of both subcarriers. Put another way, both subcarriers convey information about all four bits. At the receiver, information from both subcarriers can be combined to recover the original 4 bits.

The QAM16 and QAM64 modulations are very conventional.

Low power single carrier PHY

Finally, consider Modulation and Coding Schemes 25 to 31 (MCS25 – MCS31). This distinctly different group of modes also employs single-carrier modulation, specifically to minimize power consumption, but goes beyond that to specify an alternative channel encoding scheme that replaces LDPC with a combination of Reed-Solomon and Hamming block codes.

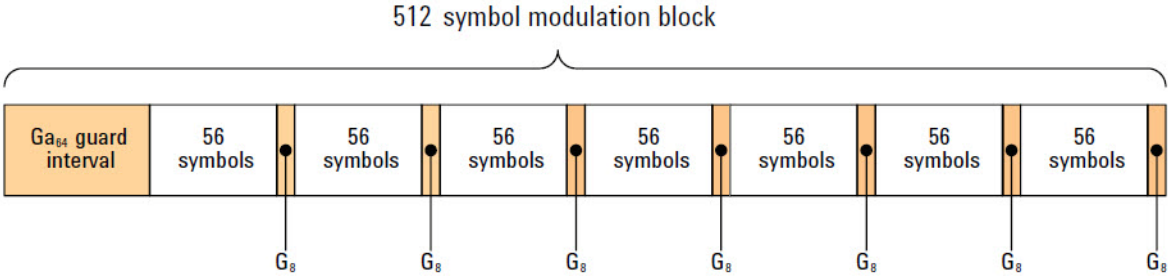
Figure 3-12 Summary block diagram of LPSCPHY coding/modulation steps



Again the motivation is to minimize power consumption. In the current state of the art, LDPC encoding/decoding consumes significantly more IC real-estate and hence power than a Reed-Solomon based solution, but that power saving comes at the expense of less robust error correction.

Nonetheless, small battery-powered devices could benefit from the extra power savings and so these MCS have been included and collectively constitute the Low Power Single Carrier PHY (LPSC-PHY). Although the LPSC PHY payload encoding is significantly different from the other modes, the LPSC PHY packets use the common preamble to facilitate coexistence with devices that do not support these MCS. MCS25 to MCS31 are optional, but a device that implements the LPSC PHY modes will still have to implement at least MCS0 to MCS4.

Figure 3-13 UPC PHY payload modulation block



The symbol blocking and guard interval divides the modulation symbols into groups of 448 symbols interspersed with 64 symbol GI in a manner compatible with the SCPHY. However the 448 symbols are further deconstructed into 7 sub-groups of 56 data symbols each postfixed with a "G_8" guard interval comprising the first 8 symbols of a Ga_{64} sequence (7 x 64 = 448). Thus each LPSCPHY block carries 392 data symbols.

The optional optional beamforming training field is the same for all packet types. It, again, comprises a pattern of modulated repeating Golay sequences, the details being determined by the Training Length and Packet Type fields in the header.

Test Scenarios

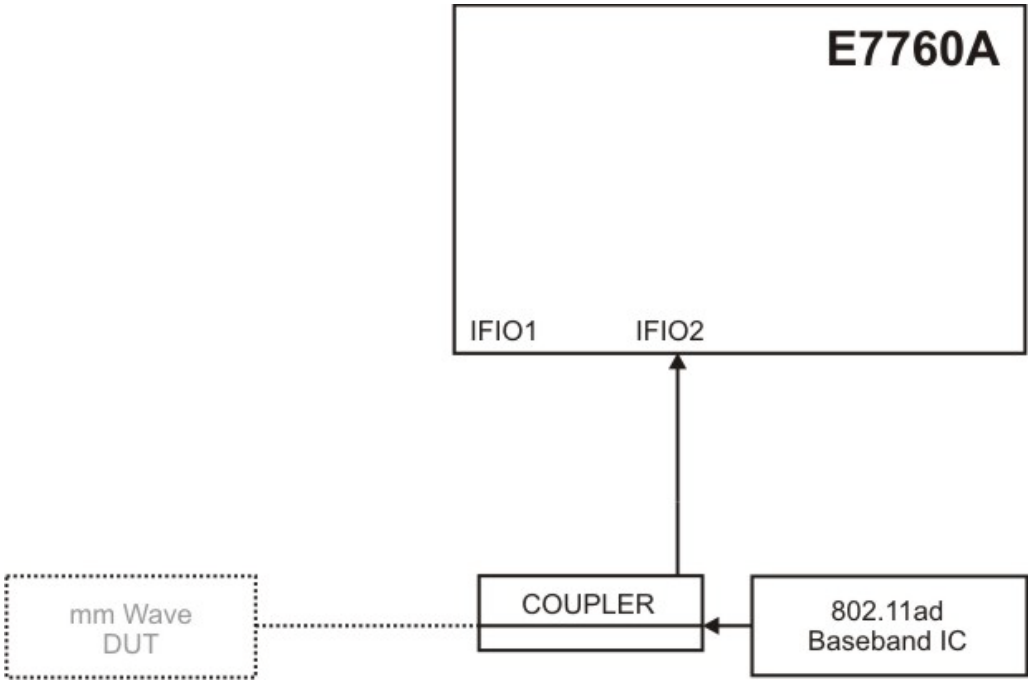
The illustrated examples below show how the ports of the E7760A are connected and used, in various common test scenarios.

Baseband TX Test

For this type of verification, only the IFIO1 and IFIO2 ports (2-18 GHz) are used. (This type of testing requires the E7760A-RF2 license.)

In the example illustrated below, the tester receives a signal from the Baseband IC at port IFIO2 (IFIO1 could also be used).

Figure 3-14 Baseband TX test

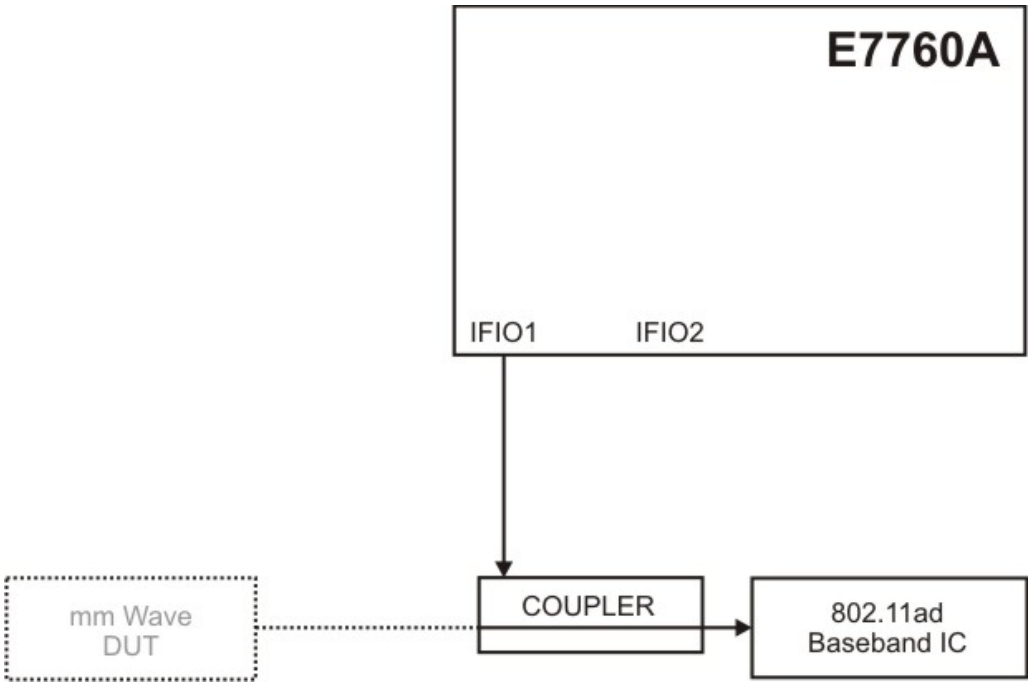


Baseband RX Test

For this type of verification, only the IFIO1 and IFIO2 ports (2-18 GHz) are used. (This type of testing requires the E7760A-RF2 license.)

In the example illustrated below, the tester supplies a stimulus signal to the Baseband IC from port IFIO1 (IFIO2 could also be used).

Figure 3-15 Baseband RX test

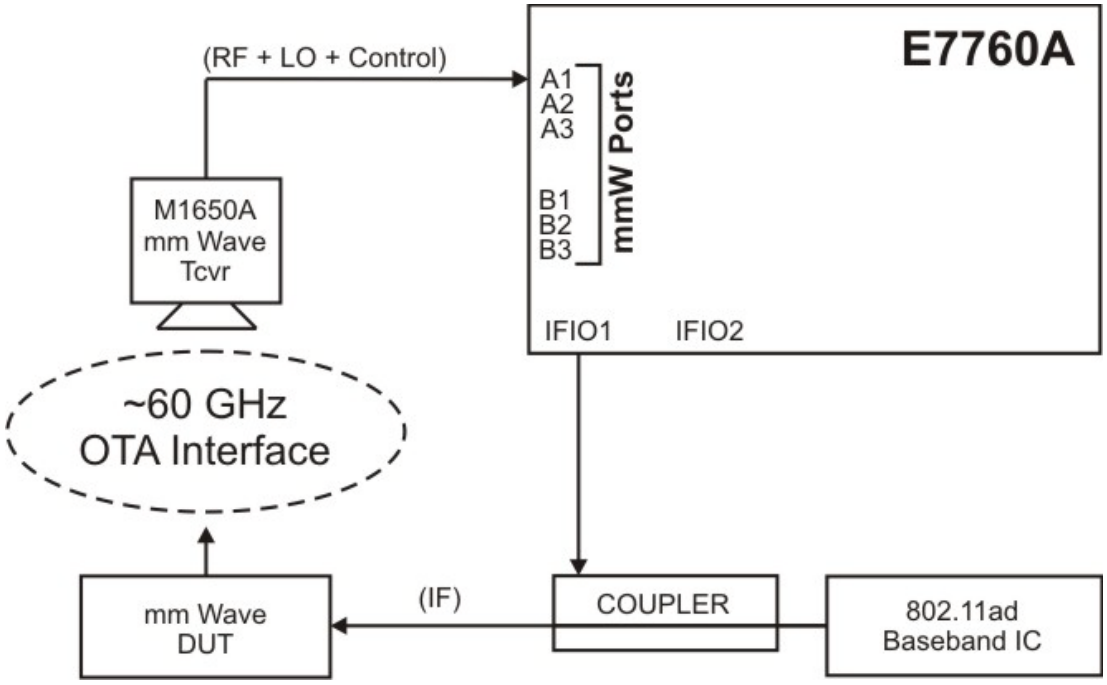


Verify DUT IF to mmW

For this type of verification, a mmWave port A1 (55-68 GHz) and IF port IFIO1 (2-18 GHz) are used. (This type of testing requires both the E7760A-RF2 license and the E7760A-RF3 license.)

In the example illustrated below, the tester provides (at port IFIO1) a stimulus signal to the mmWave DUT. The mmWave Transceiver receives a signal from the DUT, downconverts it, and applies it to the A1 port. The source and measurement operations are simultaneous (but are not at the same frequency, owing to the different types of ports used).

Figure 3-16 Verify DUT IF to mmWave

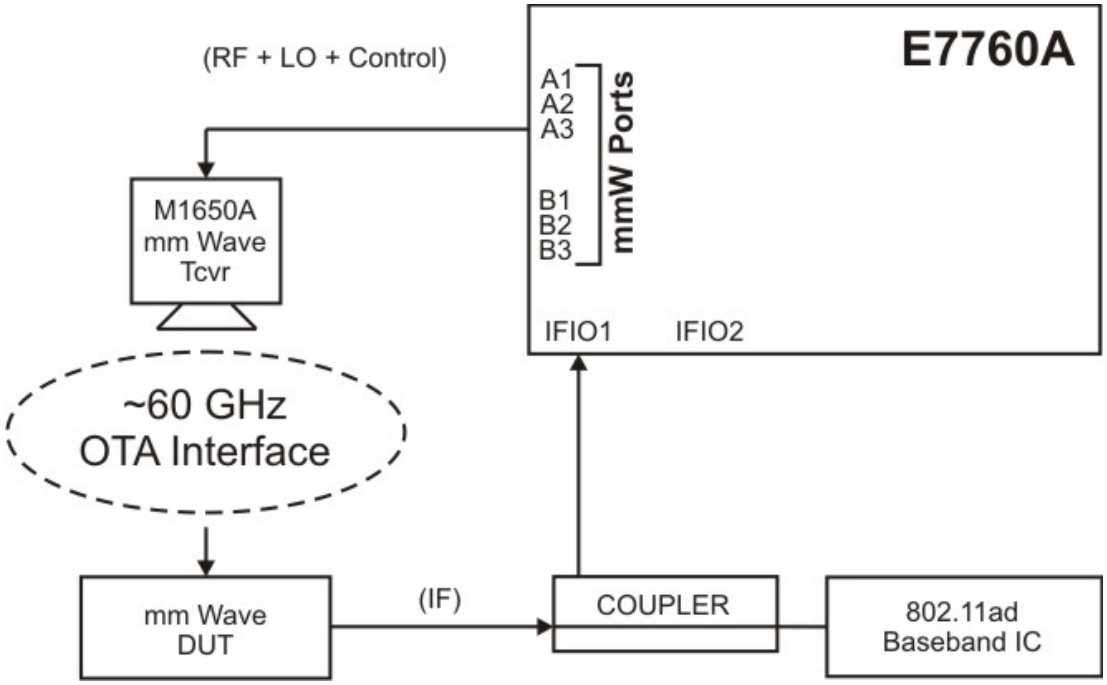


Verify DUT mmWave to IF

For this type of verification, a mmWave port A3 (55-68 GHz) and IF port IFIO1 (2-18 GHz) are used. (This type of testing requires both the E7760A-RF2 license and the E7760A-RF3 license.)

In the example illustrated below, the tester provides a stimulus signal from port A1, which is furnished to the mmWave Transceiver, upconverted, and applied to the mmWave DUT. The IF output of the DUT is received at the IFIO1 port. The source and measurement operations are simultaneous (but are not at the same frequency, owing to the different types of ports used).

Figure 3-17 Verify DUT mmWave to IF

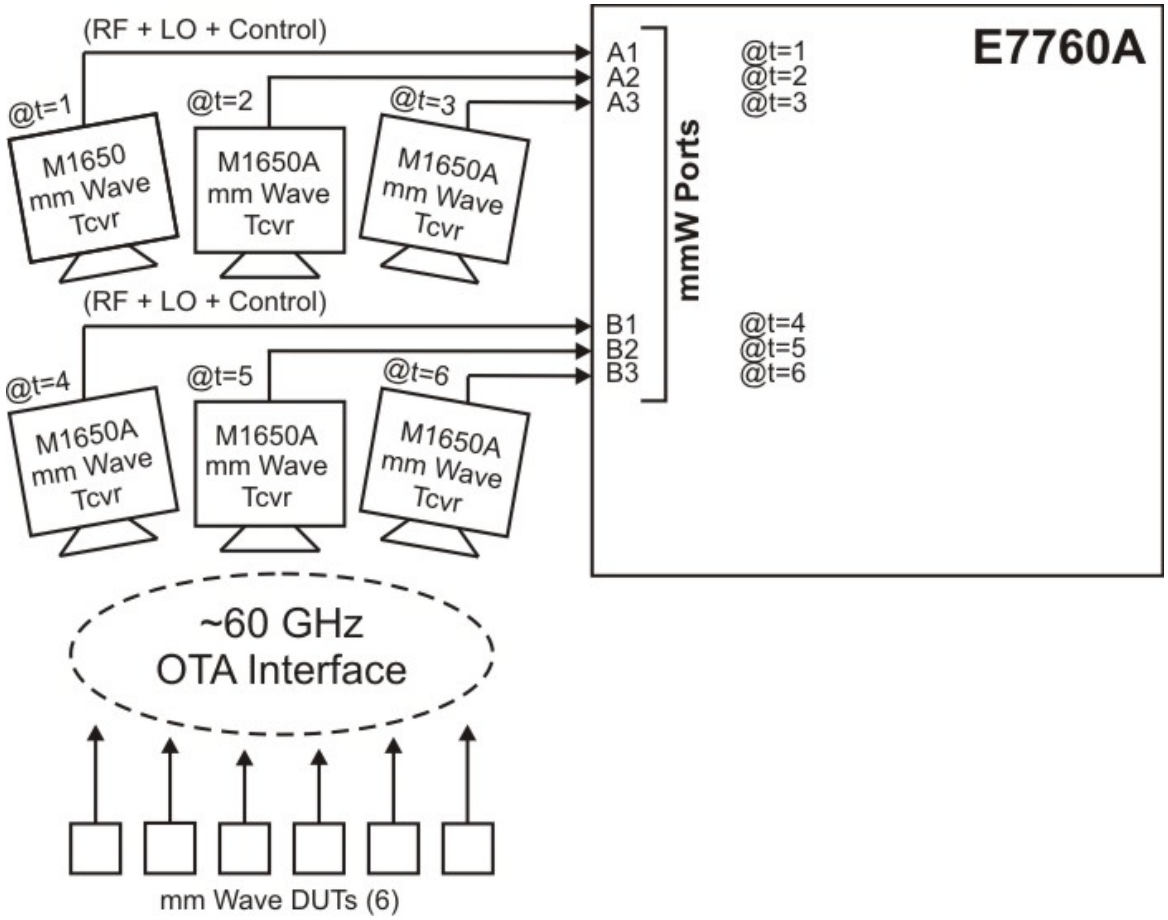


Verify TX on 6 DUTs

For this type of verification, the mmWave ports A1-A3 and B1-B3 (55-68 GHz) receive the inputs from the DUTs. (This type of testing requires the E7760A-RF3 license.)

In the example illustrated below, the signals transmitted by the mmWave DUTs are received by the mmWave Transceivers, downconverted, and applied to the mmWave ports. The six inputs to the tester are measured sequentially rather than simultaneously, so it is possible to change settings between measurements.

Figure 3-18 Verify TX on 6 DUTs

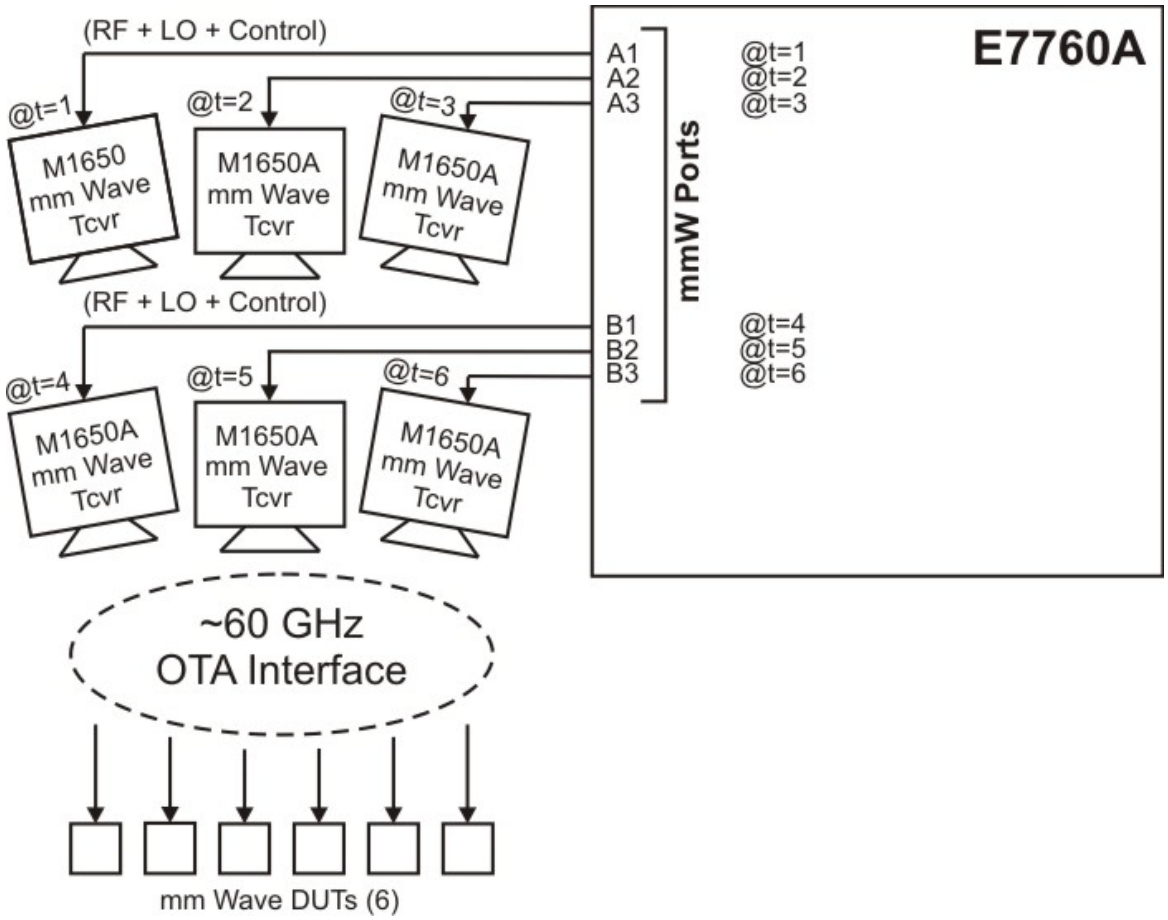


Verify RX on 6 DUTs

For this type of verification, the mmWave ports A1-A3 and B1-B3 (55-68 GHz) provide stimulus inputs to the DUTs. (This type of testing requires the E7760A-RF3 license.)

In the example illustrated below, the stimulus inputs are upconverted by the mmWave Transceivers and applied to the mmWave DUTs. The six outputs from the tester are generated sequentially rather than simultaneously, so it is possible to change settings between one instance and the next.

Figure 3-19 Verify RX on 6 DUTs



Verify TX and RX on 6 DUTs

For this type of verification, some of the mmWave ports A1-A3 and B1-B3 (55-68 GHz) are used to receive the transmitted outputs from three of the DUTs, while others to provide stimulus inputs to the other three mmWave DUTs. (This type of testing requires the E7760A-RF3 license.)

In the example illustrated below, the transmitted signals from three of the mmWave DUTs are received by the mmWave Transceivers, downconverted, and applied to the B1-B3 ports. Stimulus signals from ports A1-A3 are provided to the mmWave Transceivers, upconverted, and applied to three of the mmWave DUTs.

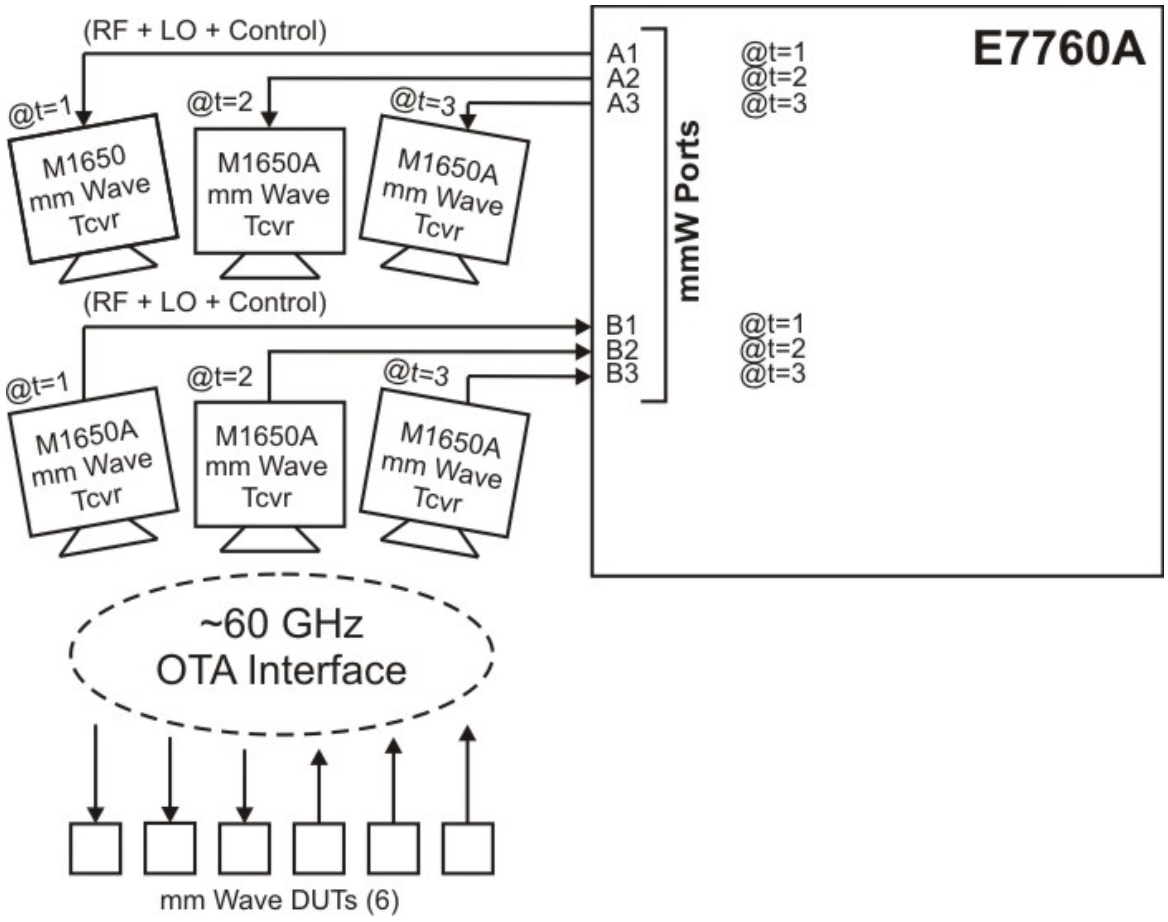
NOTE

If License E7760A-RF4 is installed, the frequency of the A1-A3 ports can be different from the frequency of the B1-B3 ports. Without the E7760A-RF4 license, all ports have the same frequency.

The stimulus and measurement functions are simultaneous for a particular pairing of ports (A1/B1, A2/B2, A3/B3), but sequential from one pair to the next (only one output port and one input port are active at a time).

While one of the "A" bank of mmWave ports is defined as an output, the input port must one of the "B" bank of ports. It isn’t possible, for example, for A1 to be the input and A2 to be the output at the same time.

Figure 3-20 Verify TX and RX on 6 DUTs



Verify DUT beam forming

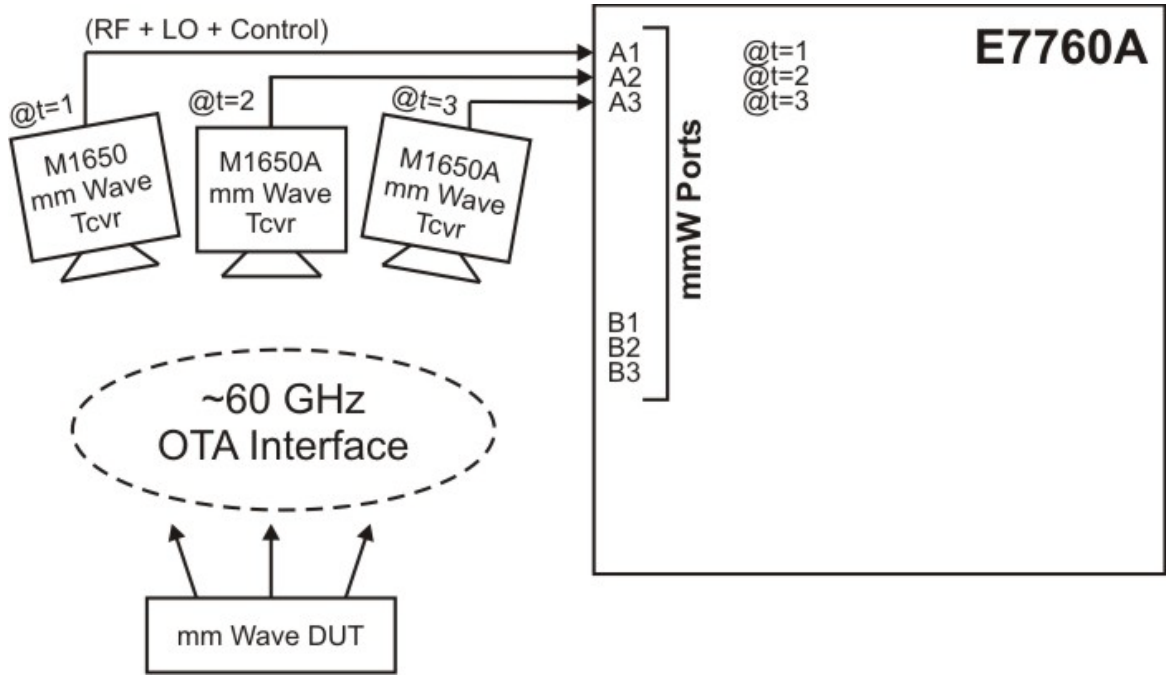
For this type of calibration/verification, the signal transmitted by the mmWave DUT is measured separately by three mmWave Transceivers. (This type of testing requires the E7760A-RF3 license.)

The same procedure could be done with a single transceiver, by changing the position of the DUT or the transceiver between measurements, but using three transceivers and a single mechanical setup is more time-efficient.

In the example illustrated below, the signal transmitted from the mmWave DUT is received by three transceivers, downconverted, and applied to ports A1-A3 for measurement.

The ports are typically set to the same frequency, but their operation is sequential rather than simultaneous, because only one port can be active at a time.

Figure 3-21 Verify DUT beam forming



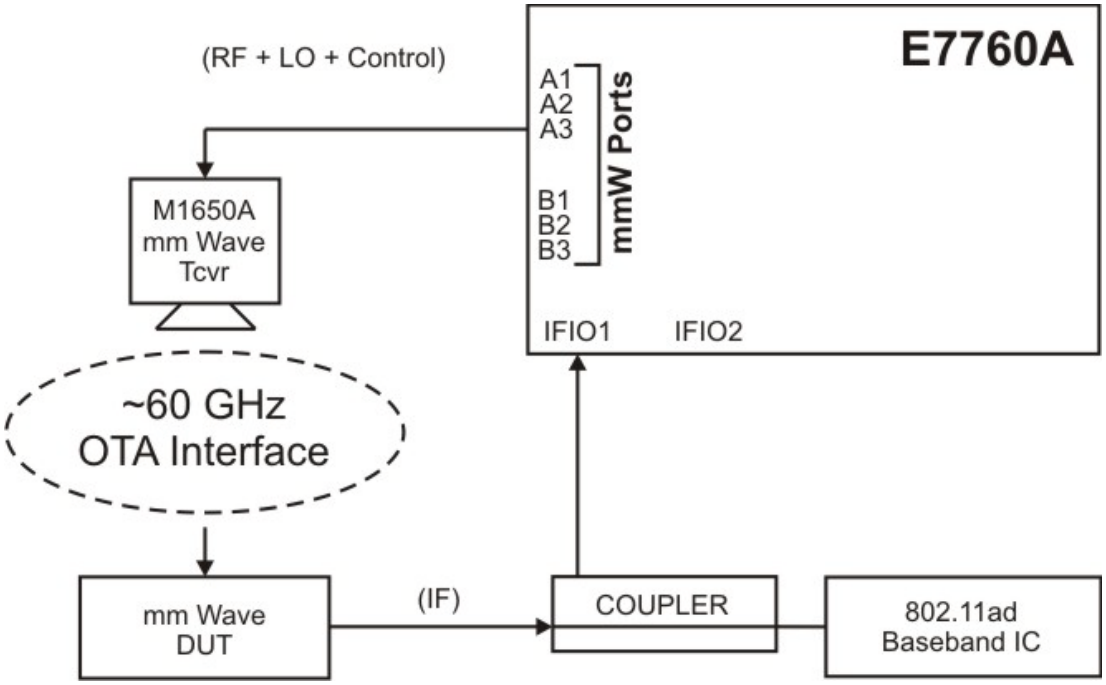
Port Configuration

Types of Ports

The E7760A has two types of ports. The six mmWave Ports (A1-A3 and B1-B3) are used in conjunction with the M1650A mmWave Transceiver, a test head which exchanges signals with a mmWave DUT through an Over-The-Air interface. The front-panel mmWave Ports do not actually send or receive mmWave signals; the M1650A provides the necessary upconversion or downconversion to achieve the desired frequency range.

The other two ports are IFIO1 and IFIO2, which have a range of 2-18 GHz,

Figure 3-22 Port types: mmWave ports and IFIO ports



A given port can be configured as the output (source) port by selecting the port at **System Configurations > Input/Output Port > Output Port**, or by sending the command:

```
:SENSe:FEED:PORT:OUTPut NONE|A1|A2|A3|B1|B2|B3|IFIO1|IFIO2
```

A given port can be configured as the input (analyzer) port by selecting the port at **System Configurations > Input/Output Port > Input Port**, or by sending the command:

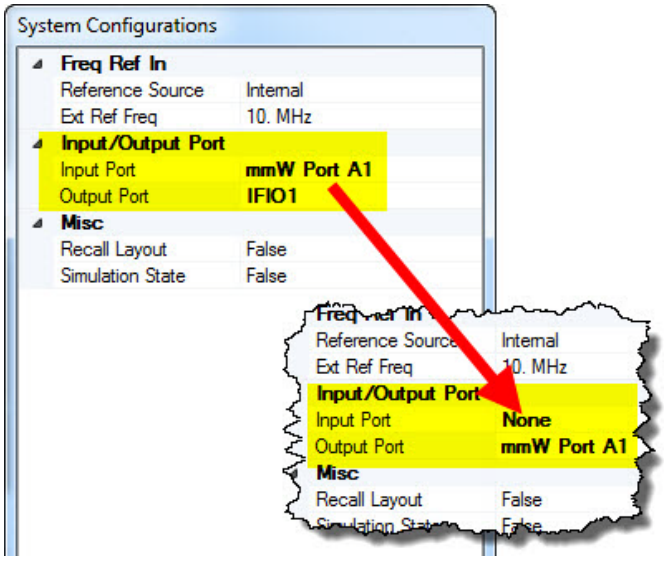
```
:SENSe:FEED:PORT[:INPut] NONE|A1|A2|A3|B1|B2|B3|IFIO1|IFIO2
```

Rules for port usage are described in the following sections.

Port Rules (mmWave Ports)

The mmWave Ports have the following usage requirements:

- The RF3 license is required to use the mmWave ports.
- The six mmWave Ports are divided into "A" and "B" banks, either of which transmit or receive but neither of which can do both at once. For example, if A1, A2 or A3 is the Output Port, then the Input Port must be one of the ports from the other bank (B1, B2, or B3).
- If License E7760A-RF4 is installed, the input port and output port can be set to different frequencies.
- It is not possible to perform a loopback test by connecting an RF cable between any two of these ports. A loopback test would require two M1650A mmWave Transceivers, one connected to a port on the "A" bank and one connected to a port on the "B" bank.
- Any M1650A mmWave Transceivers to be used must be connected to the mmWave ports **before** power is applied to the E7760A. Do not make or break such connections after the E7760A is powered up.
- In configuring the Input Port and Output Port settings, it is never possible to choose the same port (or bank of ports) for both at once. Use the "None" setting to avoid conflicts when configuring ports. For example, if you want to change the **Output Port** setting to "mmW Port A1", and that is already the **Input Port** setting, set the **Input Port** temporarily to "None" to avoid the setting conflict, and then set the **Output Port** setting to "mmW Port A1". The **Input Port** can then be given a different setting which does not conflict with the **Output Port** setting.

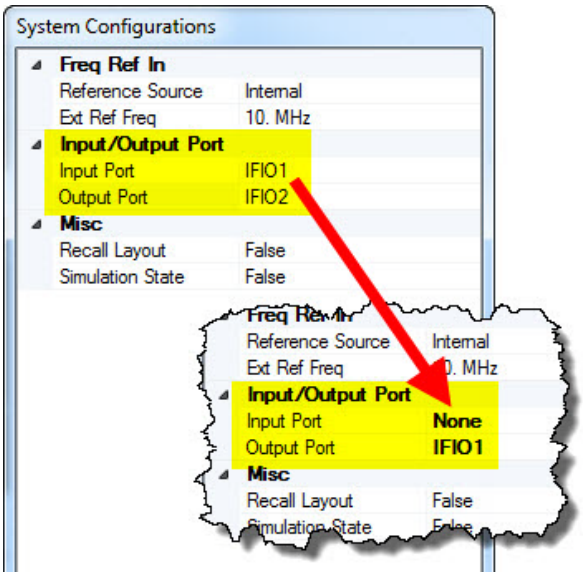


– It is not possible to set the source Output Port to "None" while the source Output On setting is "True". Before setting the Output Port to "None", set **Source Configurations > Output On** to "False" in the **Current Output Device Settings** window, or send the command `:OUTPut:STATe OFF`.

Port Rules (IO Ports)

The IFIO ports (IFIO1 and IFIO2) have the following usage requirements:

- The RF2 license is required to use the RFIO ports.
- Neither of the two RFIO ports can transmit and receive at the same time:
  - If IFIO1 is the Output Port, the Input Port must be IFIO2.
  - If IFIO2 is the Output Port, the Input Port must be IFIO1.
- In configuring the Input Port and Output Port settings, it is never possible to choose the same port for both at once. Use the "None" setting to avoid conflicts when configuring ports. For example, if you want to change the **Output Port** setting to "IFIO1", and that is already the **Input Port** setting, set the **Input Port** temporarily to "None" to avoid the setting conflict, and then set the **Outptut Port** setting to "IFIO1". The **Input Port** can then be given a different setting which does not conflict with the **Output Port** setting.

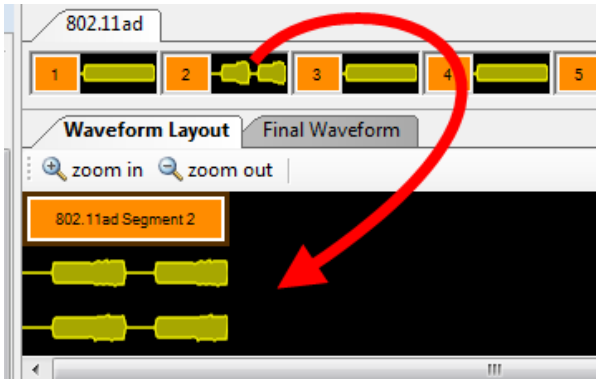
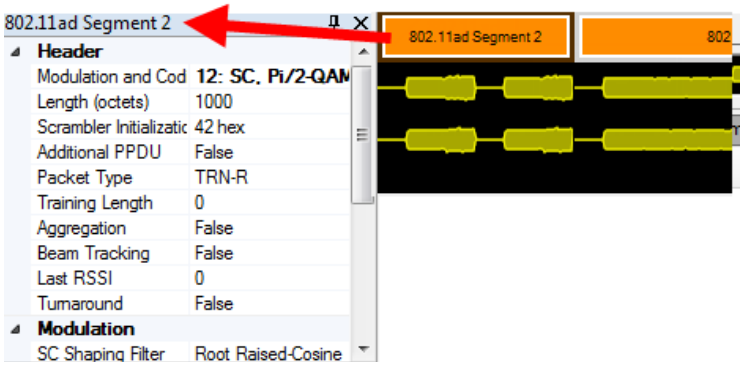


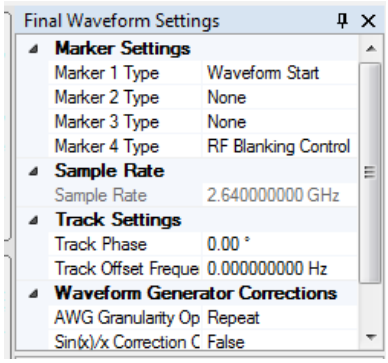
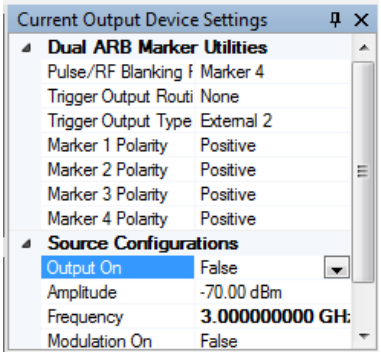
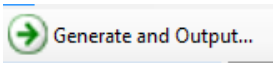
- It is not possible to set the source Output Port to None while the source Output On setting is "True". Before setting the Output Port to "None", set **Source Configurations > Output On** to "False" in the **Current Output Device Settings** window, or send the command `:OUTPut:STATe OFF`.
- The IFIO ports differ from the mmWave ports in that it is not required for the source frequency of the output port and the measurement frequency of the input port to be the same.
- The IFIO ports differ from the mmWave ports in that it is possible to connect an RF cable between one and the other for loopback testing.

Basic Process for Setting Up a Test

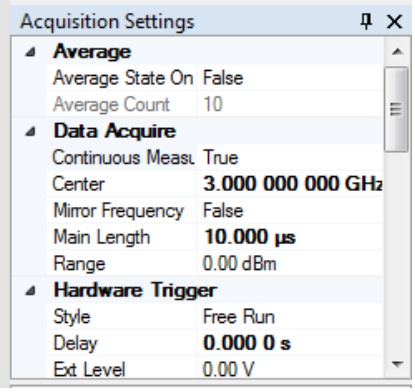
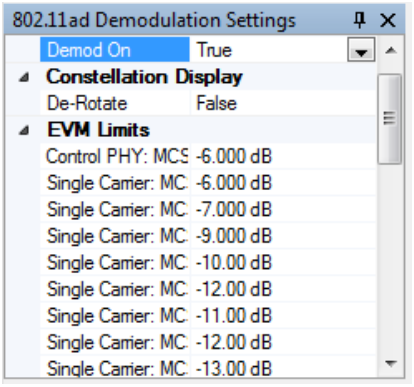
General procedures for generating a waveform and measuring a waveform are provided below.

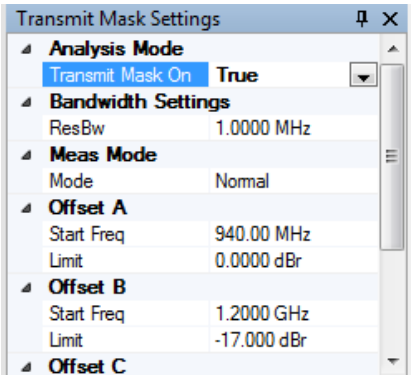
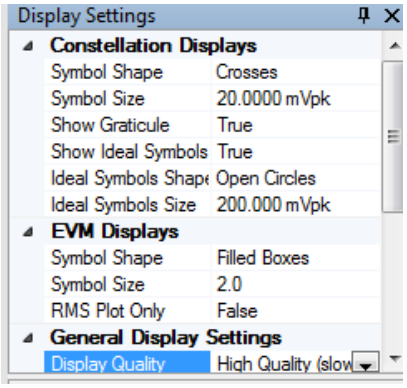
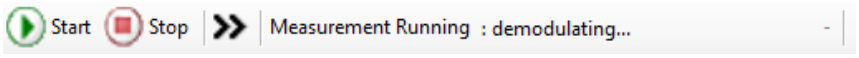
Waveform Generation Process

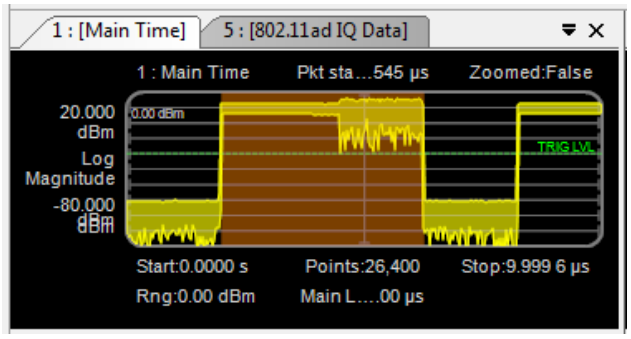
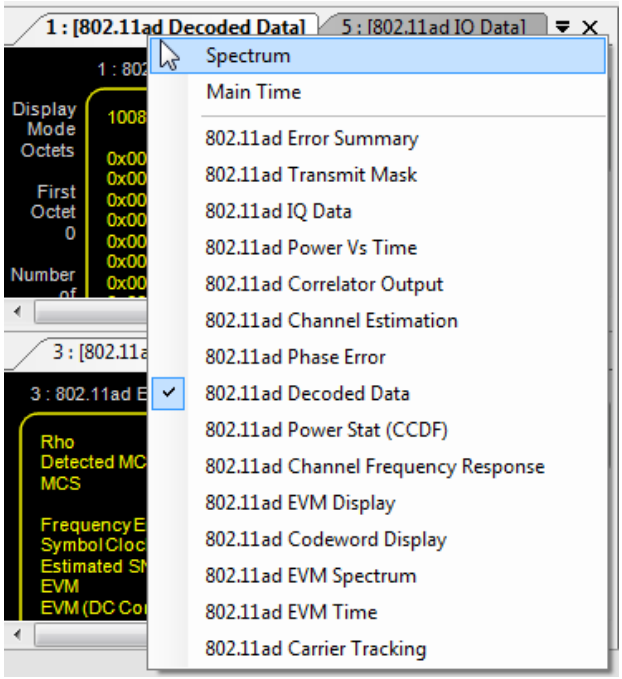
Step	Notes
1. Define the Output Port in the System Configurations window.	In the **System Configurations** window, select the **Output Port**. (For information on possible selections, see "Port Rules (mmWave Ports)" on page 138 and "Port Rules (IO Ports)" on page 140.)
2. Add waveform segment or segments.	Drag one or more segments from the **802.11ad** waveform tab to **Waveform Layout**.  Don't drag the cursor over the **Final Waveform** tab, to avoid opening that tab instead of **Waveform Layout**.
3. Make 802.11ad Segment settings.	Click the desired segment in the **Waveform Layout** window, and in the **802.11ad Segment** window, select the desired settings (including **Modulation and Coding Scheme, Modulation**, **Payload**, and **Waveform Structure**. 

Step	Notes
4. Make Final Waveform settings.	In the **Final Waveform** window, select the desired settings (including **Marker Settings**, **Track Settings**, and **Waveform Generator Corrections**. (The **Sample Rate** is displayed for reference only; it is not user-settable.) 
5. Make Current Output Device Settings.	In the **Current Output Device Settings** window, select the desired settings (including **Dual Arb Marker Utilities**, **Source Output On**, **Amplitude**, **Frequency**, and **Modulation On**. 
6. Generate and Output	Click **Generate and Output** in the toolbar, to generate the waveform. 

Measurement Process

Step	Notes
1. Define the Input Port in the System Configurations window.	In the **System Configurations** window, select the **Input Port**. (For information on possible selections, see "Port Rules (mmWave Ports)" on page 138 and "Port Rules (IO Ports)" on page 140.)
2. Make Acquisition Settings.	In the **Acquisition Settings** menu, select the desired settings for the acquisition (including **Average**, **Data Acquire**, **Hardware Trigger**, **Channel Power**, **Power Stat/CCDF**, **Spectrum**, and **Time Domain Power**.) 
3. Make 802.11ad Demodulation Settings.	In the **802.11ad Demodulation Settings** window, select the desired settings for demodulation (including **Analysis Mode**, **Constellation Display**, **EVM Limits**, **Frequency Correction**, **Packet Search**, **Ramp Time**, **Symbol Clock Settings**, and **Tracking**. 

Step	Notes
4. Make Transmit Mask Settings.	In the **Transmit Mask Settings** window, select the desired settings (including **Analysis Mode**, **Band wid th**, **Meas Mode**, and **Offsets**). 
5. Make Display Settings.	In the **Display Settings** window, select the desired settings (including **Constellation Displays**, **EVM Displays**, **General Display Settings**, **Spectrum/Main Time Displays**, **Sub-Carrier Displays**, and **Text Displays**.) 
6. Start the measurement	In the toolbar, click the **Start** and **Stop** icons to run and stop the measurement. The status of the measurement is displayed to the right. 

Step	Notes
7. Check the results in the measurement display windows.	The result of each measurement is displayed in its dedicated window.  Results can also be obtained by sending the appropriate **:FETCh** command for the measurement and result of interest; see the series of commands which begins on page 161.
8. Bringing up hidden measurement windows.	If a measurement window is not currently displayed, it can be made visible by right-clicking on the tab at the top of one of the displayed measurements and selecting a different measurement window from the menu which appears. 

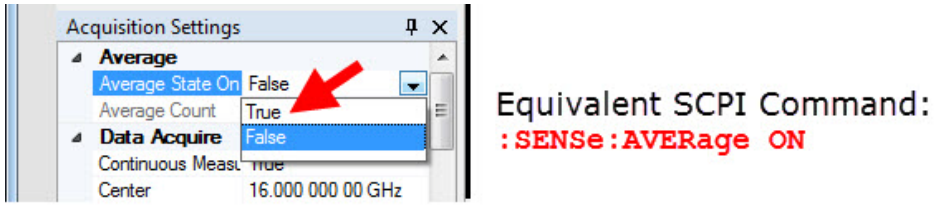
4 SCPI Commands

The following topics can be found in this chapter (the commands are in alphabetical order):

The SCPI Interface and SCPI Syntax

In addition to being controlled and monitored by way of the screen interface, the instrument can be controlled and monitored by means of SCPI commands. For example, averaging can be enabled for the acquisition in the screen interface by changing the **Averaging State On** setting to **True** in the **Acquisition Settings** window. The same thing can be done by sending the command `:SENSE:AVERage ON`.

Figure 4-1 Screen interface setting vs. SCPI command



In the SCPI command syntax, variables are indicated by angled brackets; for example, a parameter specifying an amplitude in dBm might be represented in the command syntax by the variable `<ampl>`, but in an actual command this variable be replaced by an actual value, such as `-10`.

Where a command parameter must be one of a limited set of choices, the alternatives are listed, with vertical lines separating the choices: `OFF|ON|0|1`.

The SCPI syntax allows for certain elements of a command to be omitted for brevity. Where a command name is given in a mixture of upper-case and lower-case letters, the lower-case letters are optional. Also, any element that is enclosed in brackets is optional. For example, the command which sets the source output power to a value in dBm has the following syntax:
`:OUTPut:POWer[:AMPLitude] <ampl>`

This command can be sent in its long form:
`:OUTPut:POWer:AMPLitude -10`
(Note that the brackets themselves are omitted if the optional element is included in the command.)

However, the same result is obtained by sending the command in its abbreviated form:
`:OUTP:POW -10`

NOTE

There is not always a command equivalent for a function of the screen interface (some functions which relate only to the display do not need a command). Also, there is not always a screen interface equivalent for a command (some commands perform functions which aren't available from the screen interface).

Asterisk (*) commands

*CLS command

User Interface:	(Command only)
Command:	`*CLS`
Notes:	Clears the status byte register, 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.)

*ESE command

User Interface:	(Command only)
Command:	`*ESE <integer>` `*ESE?`
Notes:	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.
Example:	`*ESE 36` 36 (equivalent to binary 00100100) enables bits 2 and 5, to monitor query and command errors.

*ESR? query

User Interface:	(Command only)
Command:	`*ESR?`
Notes:	Queries and clears the standard event status event register. (This is a destructive read.) The query returns a 1 if there is either a query or command error, otherwise it returns a zero.

*IDN? query

User Interface:	(Command only)
Command:	`*IDN?`
Notes:	Return a string of instrument identification information. The response is organized into four fields separated by commas. The field definitions are as follows: Manufacturer, Model, Serial number, Firmware version. For example: `"Keysight Technologies,E7760A,US01020004,A.01.02"`

*OPC command

User Interface:	(Command only)
Command:	`*OPC` `*OPC?`
Notes:	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 Return a "1" after all the current overlapped commands are complete; 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.
Example:	`INIT:CONT 0` Selects single measurement operation. `INIT:IMM` Initiates a measurement. `*OPC?` Holds off any further commands until the measurement is complete.

*OPT? query

User Interface:	(Command only)
Command:	`*OPT?`
Notes:	Return a string of all the installed instrument options, in the form of a comma-separated list. For example: **"503,P03,PFR"**

*RST command

User Interface:	File menu > Preset State
Command:	`*RST`
Notes:	This command is equivalent to `:SYST:PRES` followed by `: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. 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.

*SRE command

User Interface:	(Command only)
Command:	`*SRE <integer>` `*SRE?`
Notes:	This command enables the desired bits of the service request enable register (the integer is the decimal equivalent of the binary number representing the desired bits). The query Return the value of the register, indicating which bits are currently enabled.
Example:	`*SRE 22` 22 (equivalent to binary 10110) enables bits 1, 2, and 4 in the service request enable register.

*STB? query

User Interface:	(Command only)
Command:	`*STB?`
Notes:	Return the decimal equivalent of the binary value of the status byte register, without erasing its contents. For example: if a 16 is returned, this represents the status byte 00010000.

*WAI command

User Interface:	(Command only)
Command:	`*WAI`
Notes:	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.

:ABORt command

User Interface:	(Command only)
Command:	`:ABORt`
Example:	`:ABOR`
Notes:	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.

:CALCulate:SPECtrum:MARKer commands

:CALCulate:SPECtrum:MARKer:MAXimum command

User Interface:	Peak Search
Command:	`:CALCulate:SPECtrum:MARKer:MAXimum`
Example:	`:CALC:SPEC:MARK:MAX`
Notes:	Place the marker on the trace point with the maximum y-axis value.

:CALCulate:SPECtrum:MARKer:MAXimum:NEXT command

User Interface:	Next Peak
Command:	`:CALCulate:SPECtrum:MARKer:MAXimum:NEXT`
Example:	`:CALC:SPEC:MARK:MAX:NEXT`
Notes:	Place the marker on the peak that has the next highest amplitude less than the marker's current value.

:CALCulate:SPECtrum:MARKer:PEAK:EXCursion command

User Interface:	Peak Excursion
Command:	`:CALCulate:SPECtrum:MARKer:PEAK:EXCursion <rel_ampl>` `:CALCulate:SPECtrum:MARKer:PEAK:EXCursion?`
Example:	`:CALC:SPEC:MARK:PEAK:EXC 6` `:CALC:SPEC:MARK:PEAK:EXC?`
Notes:	Set or query the excursion amplitude (that is, the minimum change in amplitude, up or down) required for a signal level to be identified as a peak. The value is in dB. The query returns the current setting. (Default: 6. Range: 0 to 100.)

:CALCulate:SPECtrum:MARKer:PEAK:EXCursion:STATe command

User Interface:	Peak Excursion State
Command:	`:CALCulate:SPECtrum:MARKer:PEAK:EXCursion:STATe OFF|ON|0|1` `:CALCulate:SPECtrum:MARKer:PEAK:EXCursion:STATe?`
Example:	`:CALC:SPEC:MARK:PEAK:EXC:STAT ON` `:CALC:SPEC:MARK:PEAK:EXC:STAT?`
Notes:	Enable or disable the peak excursion requirement (the requirement that amplitude must change by a minimum amount for a signal level to be identified as a peak). Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:CALCulate:SPECtrum:MARKer:PEAK:THReshold command

User Interface:	Peak Threshold
Command:	`:CALCulate:SPECtrum:MARKer:PEAK:THReshold <ampl>` `:CALCulate:SPECtrum:MARKer:PEAK:THReshold?`
Example:	`:CALC:SPEC:MARK:PEAK:THR` `:CALC:SPEC:MARK:PEAK:THR?`
Notes:	Set or query the peak threshold amplitude in dBm (this defines the minimum signal level that the peak identification algorithm uses to recognize a peak). The query returns the current setting.

:CALCulate:SPECtrum:MARKer:PEAK:THReshold:STATe command

User Interface:	Peak Threshold State
Command:	`:CALCulate:SPECtrum:MARKer:PEAK:THReshold:STATe OFF|ON|0|1` `:CALCulate:SPECtrum:MARKer:PEAK:THReshold:STATe?`
Example:	`:CALC:SPEC:MARK:PEAK:THR:STAT ON` `:CALC:SPEC:MARK:PEAK:THR:STAT?`
Notes:	Enable or disable the peak threshold requirement (the requirement that amplitude must be at a defined minimum level to be identified as a peak). Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:CALCulate:SPECtrum:MARKer command

User Interface:	Acquisition Settings > Measure - Spectrum > Marker On
Command:	`:CALCulate:SPECtrum:MARKer[:STATe] OFF|ON|0|1` `:CALCulate:SPECtrum:MARKer[:STATe]?`
Example:	`:CALC:SPEC:MARK ON` `:CALC:SPEC:MARK?`
Notes:	Enable or disable the marker. Send 1 or ON to enable; send 0 or OFF to disable. The marker is disabled by default. The query returns the current state.

:CALCulate:SPECtrum:MARKer:X command

User Interface:	Acquisition Settings > Measure - Spectrum > Marker X
Command:	`:CALCulate:SPECtrum:MARKer:X <freq>` `:CALCulate:SPECtrum:MARKer:X?`
Example:	`:CALC:SPEC:MARK:X 4 GHZ` `:CALC:SPEC:MARK:X?`
Notes:	Set or query the frequency of the marker, in Hz. The default setting is 3 GHz. The query returns the current setting.

:CALCulate:SPECtrum:MARKer:Y? query

User Interface:	(Information displayed in Spectrum window)
Command:	`:CALCulate:SPECtrum:MARKer:Y?`
Example:	`:CALC:SPEC:MARK:Y?`
Notes:	Returns the amplitude of the marker in dBm. Example result: `-2.108734512E+01`

:CALibration commands

:CALibration command

User Interface:	System > Run Alignments > All
Command:	`:CALibration[:ALL]` `:CALibration[:ALL]?`
Example:	`:CAL?` (Runs the alignment process, then returns a confirmation of success or failure.)
Notes:	Execute an alignment of the source and analyzer subsystems. It is recommended to send this command in query form, so that the test program will wait for the confirming response after the alignment.

:CALibration:ANALyzer command

User Interface:	System > Run Alignments > Analyzer
Command:	`:CALibration:ANALyzer`
Example:	`:CAL:ANAL`
Notes:	Execute an alignment of the analyzer subsystem.

:CALibration:CABLe command

User Interface:	System > Run Alignments > Cable
Command:	`:CALibration:CABLe`
Example:	`:CAL:CABL`
Notes:	Execute an alignment of a mmWave cable. (This command is not applicable to ports IFIO1 or IFIO2.) Before sending the command, attach the RF Cable Assembly from the mmWave Port port to M1650A mmWave Transceiver. It is necessary to run this alignment again any time the mmWave Transceiver or the RF Cable Assembly is changed, or the RF Cable Assembly is moved from one port to another, or from one mmWave Transceiver to another.

:CALibration:SOURce command

User Interface:	System > Run Alignments > Source
Command:	`:CALibration:SOURce`
Example:	`:CAL:SOUR`
Notes:	Execute an alignment of the source subsystem.

:CALibration:TEMPerature:CURRent? query

User Interface:	(Command Only)
Command:	`:CALibration:TEMPerature:CURRent?`
Example:	`:CAL:TIME:LALL?`
Notes:	Return the current temperature in degrees Centigrade.

:CALibration:TEMPerature:CURRent:MMW? query

User Interface:	(Command Only)
Command:	`:CALibration:TEMPerature:CURRent:MMW? A1|A2|A3|B1|B2|B3`
Example:	`:CAL:TEMP:CURR:MMW? A1`
Notes:	Returns the current temperature of the mmWave Transceiver on the indicated port. The temperature reading is updated if you switch the Output between a mmWave Port and an IFIO port, or if the port is used for Input and you perform any operation that changes the Frequency or Range.

:CALibration:TEMerature:LALL? query

User Interface:	(Command Only)
Command:	`:CALibration:TEMPerature:LALL?`
Example:	`:CAL:TIME:LALL?`
Notes:	Return the temperature (in degrees Centigrade) at which the last successful alignment was run. (Returns NaN if no alignment has been run since power-up.)

:DISPlay: Commands

:DISPlay:SEMask:Y:MAX[:LOG] command

User Interface:	(Command Only)
Command:	`:DISPlay:SEMask:Y:MAX[:LOG] <dBm>` `:DISPlay:SEMask:Y:MAX[:LOG]?`
Example:	`:DISP:SEM:Y:MAX 10`
Notes:	Set the maximum level for the 802.11ad Transmit Mask window. The default value is 20 dBm.

:DISPlay:SEMask:Y:MIN[:LOG] command

User Interface:	(Command Only)
Command:	`:DISPlay:SEMask:Y:MIN[:LOG] <dBm>` `:DISPlay:SEMask:Y:MIN[:LOG]?`
Example:	`:DISP:SEM:Y:MIN -60`
Notes:	Set the minimum level for the 802.11ad Transmit Mask window. The default value is -80 dBm.

:DISPlay:SPECtrum:Y:MAX[:LOG] command

User Interface:	(Command Only)
Command:	`:DISPlay:SPECtrum:Y:MAX[:LOG] <dBm>` `:DISPlay:SPECtrum:Y:MAX[:LOG]?`:
Example:	`:DISP:SPEC:Y:MAX 10`
Notes:	Set the maximum level for the Spectrum window. The default value is 20 dBm.

:DISPlay:SPECtrum:Y:MIN[:LOG] command

User Interface:	(Command Only)
Command:	`:DISPlay:SPECtrum:Y:MIN[:LOG] <dBm>` `:DISPlay:SPECtrum:Y:MIN[:LOG]?`
Example:	`:DISP:SPEC:Y:MIN -60`
Notes:	Set the minimum level for the Spectrum window. The default value is -80 dBm.

:FETCh:AD:CESTimation:A queries

:FETCh:AD:CESTimation:A:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:A:I?`
Example:	`:FETC:AD:CEST:A:I?`
Notes:	Return the I data component of the 802.11ad Channel Estimation Measurement - CEF_A, as a comma-separated list of ASCII values. Example result: `-6.322610716E-06,-1.671351856E-05,-7.281037597E-06, [etc.]`

:FETCh:AD:CESTimation:A:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:A:IQ?`
Example:	`:FETC:AD:CEST:A:IQ?`
Notes:	Return the I and Q data components of the 802.11ad Channel Estimation Measurement - CEF_A, as a comma-separated list of ASCII values. The I and Q data are interleaved. Example result: `-6.322610716E-06,-6.980289413E-07,-1.671351856E-05, [etc.]`

:FETCh:AD:CESTimation:A:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:A:MAGNitude:LINear?`
Example:	`:FETC:AD:CEST:A:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Channel Estimation Measurement - CEF_A, as a comma-separated list of ASCII values. Example result: `6.361025953E-06,2.072186180E-05,1.756033816E-05, [etc.]`

:FETCh:AD:CESTimation:A:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:A:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CEST:A:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Channel Estimation Measurement - CEF_B, in dB, as a comma-separated list of ASCII values. Example result: `-1.039294586E+02,-9.367142487E+01,-9.510934448E+01, [etc.]`

:FETCh:AD:CESTimation:A:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:A:PHASe?`
Example:	`:FETC:AD:CEST:A:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Channel Estimation Measurement - CEF_A, in rad, as a comma-separated list of ASCII values. Example result: `-3.031636000E+00,-2.509113550E+00,-1.998332143E+00, [etc.]`

:FETCh:AD:CESTimation:A:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:A:Q?`
Example:	`:FETC:AD:CEST:A:Q?`
Notes:	Return the Q data component of the 802.11ad Channel Estimation Measurement - CEF_A, as a comma-separated list of ASCII values. Example result: `-6.980289413E-07,-1.224964763E-05,-1.597973642E-05, [etc.]`

:FETCh:AD:CESTimation:A:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:A:UPHase?`
Example:	`:FETC:AD:CEST:A:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Channel Estimation Measurement - CEF_A, in rad, as a comma-separated list of ASCII values. Example result: `-3.031636000E+00,-2.509113550E+00,-1.998332143E+00, [etc.]`

:FETCh:AD:CESTimation:AB queries

:FETCh:AD:CESTimation:AB:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:AB:I?`
Example:	`:FETC:AD:CEST:AB:I?`
Notes:	Return the I data component of the 802.11ad Channel Estimation Measurement - CEF_AB (combined), as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:AB:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:AB:IQ?`
Example:	`:FETC:AD:CEST:AB:IQ?`
Notes:	Return the I and Q data components of the 802.11ad Channel Estimation Measurement - CEF_AB (combined), as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CESTimation:AB:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:AB:MAGNitude:LINear?`
Example:	`:FETC:AD:CEST:AB:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Channel Estimation Measurement - CEF_AB (combined), as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:AB:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:AB:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CEST:AB:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Channel Estimation Measurement - CEF_AB (combined), in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:AB:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:AB:PHASe?`
Example:	`:FETC:AD:CEST:AB:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Channel Estimation Measurement - CEF_AB (combined), in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:AB:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:AB:Q?`
Example:	`:FETC:AD:CEST:AB:Q?`
Notes:	Return the Q data component of the 802.11ad Channel Estimation Measurement - CEF_AB (combined), as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:AB:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:AB:UPHase?`
Example:	`:FETC:AD:CEST:AB:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Channel Estimation Measurement - CEF_AB (combined), in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:B querries

:FETCh:AD:CESTimation:B:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:B:I?`
Example:	`:FETC:AD:CEST:B:I?`
Notes:	Return the I data component of the 802.11ad Channel Estimation Measurement - CEF_B, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:B:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:B:IQ?`
Example:	`:FETC:AD:CEST:B:IQ?`
Notes:	Return the I and Q data components of the 802.11ad Channel Estimation Measurement - CEF_B, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CESTimation:B:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:B:MAGNitude:LINear?`
Example:	`:FETC:AD:CEST:B:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Channel Estimation Measurement - CEF_B, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:B:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:B:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CEST:A:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Channel Estimation Measurement - CEF_B, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:B:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:B:PHASe?`
Example:	`:FETC:AD:CEST:B:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Channel Estimation Measurement - CEF_B, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:B:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:B:Q?`
Example:	`:FETC:AD:CEST:B:Q?`
Notes:	Return the Q data component of the 802.11ad Channel Estimation Measurement - CEF_B, as a comma-separated list of ASCII values.

:FETCh:AD:CESTimation:B:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CESTimation:B:UPHase?`
Example:	`:FETC:AD:CEST:B:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Channel Estimation Measurement - CEF_B, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CFResponse queries

:FETCh:AD:CFResponse:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CFResponse:I?`
Example:	`:FETC:AD:CFR:I?`
Notes:	Return the I data component of the Channel Frequency Response, as a set of comma-separated ASCII values.

:FETCh:AD:CFResponse:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CFResponse:IQ?`
Example:	`:FETC:AD:CFR:IQ?`
Notes:	Return the I and Q data component of the Channel Frequency Response, as a set of comma-separated ASCII values. The I and Q data values are interleaved.

:FETCh:AD:CFResponse:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CFResponse:MAGNitude:LINear?`
Example:	`:FETC:AD:CFR:MAGN:LIN?`
Notes:	Return the linear magnitude of the Channel Frequency Response, as a set of comma-separated ASCII values.

:FETCh:AD:CFResponse:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CFResponse:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CFR:MAGN?`
Notes:	Return the logarithmic magnitude of the Channel Frequency Response in dB, as a set of comma-separated ASCII values.

:FETCh:AD:CFResponse:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CFResponse:PHASe?`
Example:	`:FETC:AD:CFR:PHAS?`
Notes:	Return the wrapped phase component of the Channel Frequency Response in rad, as a set of comma-separated ASCII values.

:FETCh:AD:CFResponse:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CFResponse:Q?`
Example:	`:FETC:AD:CFR:Q?`
Notes:	Return the Q data component of the Channel Frequency Response, as a set of comma-separated ASCII values.

:FETCh:AD:CFResponse:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CFResponse:UPHase?`
Example:	`:FETC:AD:CFR:UPH?`
Notes:	Return the unwrapped phase component of the Channel Frequency Response in rad, as a set of comma-separated ASCII values.

:FETCh:AD:CORRelation:GA128 queries

:FETCh:AD:CORRelation:GA128:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA128:I?`
Example:	`:FETC:AD:CORR:GA128:I?`
Notes:	Return the I data component of the 802.11ad Correlation Measurement - Ga128, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA128:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA128:IQ?`
Example:	`:FETC:AD:CORR:GA128:IQ?`
Notes:	Return the I and Q data component of the 802.11ad Correlation Measurement - Ga128, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CORRelation:GA128:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA128:MAGNitude:LINear?`
Example:	`:FETC:AD:CORR:GA128:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Correlation Measurement - Ga128, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA128:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA128:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CORR:GA128:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Correlation Measurement - Ga128, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA128:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA128:PHASe?`
Example:	`:FETC:AD:CORR:GA128:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Correlation Measurement - Ga128, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA128:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA128:Q?`
Example:	`:FETC:AD:CORR:GA128:Q?`
Notes:	Return the Q data component of the 802.11ad Correlation Measurement - Ga128, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA128:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA128:UPHase?`
Example:	`:FETC:AD:CORR:GA128:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Correlation Measurement - Ga128, in rad, as a comma-separated list of ASCII values.

FETCh:AD:CORRelation:GA32 queries

:FETCh:AD:CORRelation:GA32:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA32:I?`
Example:	`:FETC:AD:CORR:GA32:I?`
Notes:	Return the I data component of the 802.11ad Correlation Measurement - Ga32, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA32:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA32:IQ?`
Example:	`:FETC:AD:CORR:GA32:IQ?`
Notes:	Return the I and Q data component of the 802.11ad Correlation Measurement - Ga32, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CORRelation:GA32:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA32:MAGNitude:LINear?`
Example:	`:FETC:AD:CORR:GA32:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Correlation Measurement - Ga32, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA32:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA32:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CORR:GA32:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Correlation Measurement - Ga32, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA32:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA32:PHASe?`
Example:	`:FETC:AD:CORR:GA32:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Correlation Measurement - Ga32, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA32:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA32:Q?`
Example:	`:FETC:AD:CORR:GA32:Q?`
Notes:	Return the Q data component of the 802.11ad Correlation Measurement - Ga32, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA32:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA32:UPHase?`
Example:	`:FETC:AD:CORR:GA32:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Correlation Measurement - Ga32, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA64 queries

:FETCh:AD:CORRelation:GA64:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA64:I?`
Example:	`:FETC:AD:CORR:GA64:I?`
Notes:	Return the I data component of the 802.11ad Correlation Measurement - Ga64, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA64:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA64:IQ?`
Example:	`:FETC:AD:CORR:GA64:IQ?`
Notes:	Return the I and Q data component of the 802.11ad Correlation Measurement - Ga64, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CORRelation:GA64:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA64:MAGNitude:LINear?`
Example:	`:FETC:AD:CORR:GA64:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Correlation Measurement - Ga64, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA64:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA64:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CORR:GA64:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Correlation Measurement - Ga64, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA64:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA64:PHASe?`
Example:	`:FETC:AD:CORR:GA64:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Correlation Measurement - Ga64, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA64:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA64:Q?`
Example:	`:FETC:AD:CORR:GA64:Q?`
Notes:	Return the Q data component of the 802.11ad Correlation Measurement - Ga64, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GA64:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GA64:UPHase?`
Example:	`:FETC:AD:CORR:GA64:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Correlation Measurement - Ga64, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB128 queries

:FETCh:AD:CORRelation:GB128:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB128:I?`
Example:	`:FETC:AD:CORR:GB128:I?`
Notes:	Return the I data component of the 802.11ad Correlation Measurement - Gb128, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB128:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB128:IQ?`
Example:	`:FETC:AD:CORR:GB128:IQ?`
Notes:	Return the I and Q data component of the 802.11ad Correlation Measurement - Gb128, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CORRelation:GB128:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB128:MAGNitude:LINear?`
Example:	`:FETC:AD:CORR:GB128:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Correlation Measurement - Gb128, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB128:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB128:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CORR:GB128:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Correlation Measurement - Gb128, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB128:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB128:PHASe?`
Example:	`:FETC:AD:CORR:GB128:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Correlation Measurement - Gb128, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB128:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB128:Q?`
Example:	`:FETC:AD:CORR:GB128:Q?`
Notes:	Return the Q data component of the 802.11ad Correlation Measurement - Gb128, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB128:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB128:UPHase?`
Example:	`:FETC:AD:CORR:GB128:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Correlation Measurement - Gb128, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB32 queries

:FETCh:AD:CORRelation:GB32:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB32:I?`
Example:	`:FETC:AD:CORR:GB32:I?`
Notes:	Return the I data component of the 802.11ad Correlation Measurement - Gb32, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB32:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB32:IQ?`
Example:	`:FETC:AD:CORR:GB32:IQ?`
Notes:	Return the I and Q data component of the 802.11ad Correlation Measurement - Gb32, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CORRelation:GB32:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB32:MAGNitude:LINear?`
Example:	`:FETC:AD:CORR:GB32:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Correlation Measurement - Gb32, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB32:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB32:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CORR:GB32:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Correlation Measurement - Gb32, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB32:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB32:PHASe?`
Example:	`:FETC:AD:CORR:GB32:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Correlation Measurement - Gb32, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB32:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB32:Q?`
Example:	`:FETC:AD:CORR:GB32:Q?`
Notes:	Return the Q data component of the 802.11ad Correlation Measurement - Gb32, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB32:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB32:UPHase?`
Example:	`:FETC:AD:CORR:GB32:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Correlation Measurement - Gb32, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB64 queries

:FETCh:AD:CORRelation:GB64:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB64:I?`
Example:	`:FETC:AD:CORR:GB64:I?`
Notes:	Return the I data component of the 802.11ad Correlation Measurement - Gb64, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB64:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB64:IQ?`
Example:	`:FETC:AD:CORR:GB64:IQ?`
Notes:	Return the I and Q data component of the 802.11ad Correlation Measurement - Gb64, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:CORRelation:GB64:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB64:MAGNitude:LINear?`
Example:	`:FETC:AD:CORR:GB64:MAGN:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Correlation Measurement - Gb64, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB64:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB64:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:CORR:GB64:MAGN?`
Notes:	Return the logarithmic magnitude of the 802.11ad Correlation Measurement - Gb64, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB64:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB64:PHASe?`
Example:	`:FETC:AD:CORR:GB64:PHAS?`
Notes:	Return the wrapped phase component of the 802.11ad Correlation Measurement - Gb64, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB64:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB64:Q?`
Example:	`:FETC:AD:CORR:GB64:Q?`
Notes:	Return the Q data component of the 802.11ad Correlation Measurement - Gb64, as a comma-separated list of ASCII values.

:FETCh:AD:CORRelation:GB64:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CORRelation:GB64:UPHase?`
Example:	`:FETC:AD:CORR:GB64:UPH?`
Notes:	Return the unwrapped phase component of the 802.11ad Correlation Measurement - Gb64, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CTRacking query

User Interface:	(Command only)
Command:	`:FETCh:AD:CTRacking?`
Example:	`:FETC:AD:CTR?`
Notes:	Return the results of the 802.11ad Carrier Tracking measurement, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:CWORd queries

:FETCh:AD:CWORd:COUNt? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CWORd:COUNt?`
Example:	`:FETC:AD:CWOR:COUN?`
Notes:	Return the number of valid 802.11ad code words (always an integer). Query this before querying the actual data or parity results to avoid trying to read empty responses.

:FETCh:AD:CWORd:DATA? query

User Interface:	See the [802.11ad Codeword Display] window
Command:	`:FETCh:AD:CWORd:DATA[1]|2|3...1600?`
Example:	`:FETC:AD:CWOR:DATA2?`
Notes:	Return the demodulated codeword data for the specified codeword. DATA1 represents the first codeword (index 0), DATA 2 the second (index 1),and so on.

:FETCh:AD:CWORd:PARity? query

User Interface:	(Command only)
Command:	`:FETCh:AD:CWORd:PARity?`
Example:	`:FETC:AD:CWOR:PAR?`
Notes:	Return the code word parity (1 if true, 0 if false) as a comma-separated list of ASCII values.

:FETCh:AD:DDATa query

User Interface:	(Command only)
Command:	`:FETCh:AD:DDATa?`
Example:	`:FETC:AD:DDAT?`
Notes:	Return the decoded 802.11ad data.

:FETCh:AD:IQ[:DATA] queries

:FETCh:AD:IQ[:DATA]:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ[:DATA]:I?`
Example:	`:FETC:AD:IQ:I?`
Notes:	Return the I data component of the IQ Data, in Vpk, as a comma-separated list of ASCII values.

:FETCh:AD:IQ[:DATA]:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ[:DATA]:IQ?`
Example:	`:FETC:AD:IQ:IQ?`
Notes:	Return the I and Q data components of the IQ Data, in Vpk, as a comma-separated list of ASCII values.

:FETCh:AD:IQ[:DATA]:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ[:DATA]:MAGNitude:LINear?`
Example:	`:FETC:AD:IQ:MAGN:LIN?`
Notes:	Return the linear magnitude of the IQ Data, in Vpk, as a comma-separated list of ASCII values.

:FETCh:AD:IQ[:DATA]:MAGNitude?

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ[:DATA]:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:IQ:MAGN?`
Notes:	Return the logarithmic magnitude of the IQ Data, in dBm, as a comma-separated list of ASCII values.

:FETCh:AD:IQ[:DATA]:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ[:DATA]:PHASe?`
Example:	`:FETC:AD:IQ:PHAS?`
Notes:	Return the wrapped phase component of the IQ Data, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:IQ[:DATA]:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ[:DATA]:Q?`
Example:	`:FETC:AD:IQ:Q?`
Notes:	Return the Q data component of the IQ Data, in Vpk, as a comma-separated list of ASCII values.

:FETCh:AD:IQ[:DATA]:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ[:DATA]:UPHase?`
Example:	`:FETC:AD:IQ:UPH?`
Notes:	Return the unwrapped phase component of the IQ Data, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:EVM queries

:FETCh:AD:IQ:EVM:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:EVM:I?`
Example:	`:FETC:AD:IQ:EVM:I?`
Notes:	Return the I data component of the EVM for each constellation point, in %, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:EVM:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:EVM:IQ?`
Example:	`:FETC:AD:IQ:EVM:IQ?`
Notes:	Return the I and Q data component of the EVM for each constellation point, in %, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:IQ:EVM:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:EVM:MAGNitude:LINear?`
Example:	`:FETC:AD:IQ:EVM:MAGN:LIN?`
Notes:	Return the linear magnitude of the EVM for each constellation point, in %, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:EVM:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:EVM:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:IQ:EVM:MAGN?`
Notes:	Return the logarithmic magnitude of the EVM for each constellation point, in dB, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:EVM:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:EVM:PHASe?`
Example:	`:FETC:AD:IQ:EVM:PHAS?`
Notes:	Return the wrapped phase component of the EVM for each constellation point, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:EVM:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:EVM:Q?`
Example:	`:FETC:AD:IQ:EVM:Q?`
Notes:	Return the Q data component of the EVM for each constellation point, in %, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:EVM:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:EVM:UPHase?`
Example:	`:FETC:AD:IQ:EVM:UPH?`
Notes:	Return the unwrapped phase component of the EVM for each constellation point, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:GRATicule queries

:FETCh:AD:IQ:GRATicule:I? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:GRATicule:I?`
Example:	`:FETC:AD:IQ:GRAT:I?`
Notes:	Return the I data component of the Ideal Constellation Points, in Vpk, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:GRATicule:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:GRATicule:IQ?`
Example:	`:FETC:AD:IQ:GRAT:IQ?`
Notes:	Return the I and Q data component of the Ideal Constellation Points, in Vpk, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:IQ:GRATicule:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:GRATicule:MAGNitude:LINear?`
Example:	`:FETC:AD:IQ:GRAT:MAGN:LIN?`
Notes:	Return the linear magnitude of the Ideal Constellation Points, in Vpk, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:GRATicule:MAGNitude? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:GRATicule:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:AD:IQ:GRAT:MAGN?`
Notes:	Return the logarithmic magnitude of the Ideal Constellation Points,in dBm, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:GRATicule:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:GRATicule:PHASe?`
Example:	`:FETC:AD:IQ:GRAT:PHAS?`
Notes:	Return the wrapped phase component of the Ideal Constellation Points, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:IQ:GRATicule:Q? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:GRATicule:Q?`
Example:	`:FETC:AD:IQ:GRAT:Q?`
Notes:	Return the I and Q data component of the Ideal Constellation Points, in Vpk, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:AD:IQ:GRATicule:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:AD:IQ:GRATicule:UPHase?`
Example:	`:FETC:AD:IQ:GRAT:UPH?`
Notes:	Return the unwrapped phase component of the Ideal Constellation Points, in rad, as a comma-separated list of ASCII values.

:FETCh:AD[:METRics] queries

:FETCh:AD[:METRics]? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]?`
Example:	`:FETC:AD`?
Notes:	Returns the last set of 802.11ad demodulation metrics. These are the same results shown in the "802.11ad Error Summary" window. Example result: `9.9902E-01,3.5782E+01,2.8367E+00,9.91E+37,2.8008E+00,2.8367E+00,9.91E+37,1.4391E+03,0.0E+00,9.91E+37,-4.6935E+01,2.5750E-02,2.1161E-01,-2.0112E+01,42689,1,42689,0,0,0,0,4,0,1000,0,66,0,0,0,0,2.0888E+00,2.7929E+00,2.8131E+00` The values returned (and their units, if any) are listed in the rows below:
Rho::	Correlation coefficient
Estimated SNR:	Estimated signal to noise ratio in dB.
EVM:	Error vector magnitude in %.
Average EVM:	(Not available.)
EVM (DC Compensated):	The EVM result without DC, in %. (Not available when MCS type is MCS0.)
Peak EVM:	The maximum EVM result found during averaging, in %
Peak EVM Location:	(Not available.)
Frequency Error:	The difference between the actual carrier frequency and the estimated carrier frequency, in Hz.
Symbol Clock Error:	Symbol clock error in ppm.
Frequency Estimate:	(Not available.)
I&Q DC Offset:	I&Q DC offset in dB.
IQ Amplitude Imbalance:	IQ amplitude imbalance in dB.
LO Quadrature Error:	LO quadrature error in degrees.
Packet Power:	The power of the detected packet in dBm.

User Interface:	(Command only)
Computed HCS:	This is the computed Header Check Sum, returned as a decimal value (always an integer).
HCS Status:	Header Check Sum status. Returns 1 if true, 0 if false.
Received HCS:	This is the received Header Check Sum, returned as a decimal value (always an integer).
Additional PPDU:	1 indicates that this PPDU is immediately followed by another PPDU with no IFS or preamble on the subsequent PPDU. 0 indicates no additional PPDU follows this PPDU.
Aggregation:	1 indicates that the PPDU in the data portion of the packet contains an A-MPDU. 0 indicates this is a packet without A-MPDU.
Beam Tracking Request:	1 indicates the need for beam tracking. 0 indicates there is no need for beam tracking.
DTP Indicator:	Always 0 (this is not supported for MCS0 - MCS12).
MCS:	Index of the Modulation and Coding Scheme (0 to 12).
Packet Type:	1 indicates a packet whose data part is followed by one or more TRN-T subfields. 0 indicates either a packet whose data part is followed by one or more TRN-R subfields, or a packet that is requesting TRN-R subfields to be appended to a future response.
PSDU Length:	Number of data octets in the PSDU.
Reserved Bits:	Always zero; ignored by the receiver.
Scrambler Initialization:	Bits X1–X7 of the initial scrambler state. This is the scrambler initialization in decimal.
Tone Pairing Type:	Always 0 (this is not supported for MCS0 - MCS12).
Training Length:	If the Beam Tracking Request field is 0, the Training Length field indicates the length of the training field. A value of 0 indicates that no training field is present in this PPDU. If the Beam Tracking Request field is 1 and the Packet Type field is 1, the Training Length field indicates the length of the training field. However, if the Packet Type field is 0, the Training Length field indicates the length of the training field requested for receive training..
Last RSSI:	Value of 0 indicates that the previous packet was not received a SIFS period before the current transmission. Value of 1 represents a power less than or equal to –68 dBm. Value of 2 to 14 represent power levels (–71+value×2) dBm. Value of 15 represents a power greater than or equal to –42 dBm.
Turnaround:	Corresponds to SIFS Response bit. Returns 1 if true, 0 if false
Data EVM:	The EVM of the portion of the signal that contains 802.11ad data.
Guard EVM:	The EVM of the portion of the signal that contains the Guard Interval.
Pilot EVM:	The EVM of the Preamble (the CEF and STF in Header).

:FETCh:AD[:METRics]:DRATe? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:DRATe?`
Example:	`:FETC:AD:DRAT?`
Notes:	Returns the data bit rage in Mbps. The rate varies depending on the MCS index; it can be as low as 27.5 Mbps (MCS0) and as high as 4620 Mbps (MCS12). Example result: `27.5E+06`

:FETCh:AD[:METRics]:EVM? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:EVM?`
Example:	`:FETC:AD:EVM?`
Notes:	Returns 3 comma-separated values. The first value is EVM linear in %. The second value is EVM log in dB. The third value is a Boolean pass/fail result for EVM. Example result: `3.5376E-01,-4.9026E+01,0`

:FETCh:AD[:METRics]:EVM:SPECtrum:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:EVM:SPECtrum:LINear?`
Example:	`:FETC:AD:EVM:SPEC:LIN?`
Notes:	Returns the Error Vector Magnitude (EVM) vs. frequency trace as comma-separated values in %. Example result: `2.347479388E-02,2.628867142E-02,3.217356279E-02,...`

:FETCh:AD[:METRics]:EVM:SPECtrum:LOGarithmic? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:EVM:SPECtrum:LOGarithmic?`
Example:	`:FETC:AD:EVM:SPEC:LOG?`
Notes:	Returns the Error vector Magnitude (EVM) vs. frequency trace as comma-separated values in dB. Example result: `-7.260694885E+01,-7.164694977E+01,-6.987482452E+01,...`

:FETCh:AD[:METRics]:EVM:TIME:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:EVM:TIME:LINear?`
Example:	`:FETC:AD:METR:EVM:TIME:LIN?`
Notes:	Returns the Error Vector Time Trace, which shows the time-domain error vector trace data results. This trace contains the computed EVM between corresponding symbol points in the I/Q measured and I/Q reference signals, as comma-separated values in %. Example result: `2.743700743E-01,4.669883847E-01,2.452830598E-02,...`

:FETCh:AD[:METRics]:EVM:TIME:LOGarithmic? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:EVM:TIME:LOGarithmic?`
Example:	`:FETC:AD:EVM:TIME:LOG?`
Notes:	Returns the Error Vector Time Trace, which shows the time-domain error vector trace data results. This trace contains the computed EVM between corresponding symbol points in the I/Q measured and I/Q reference signals, as comma-separated values in dB. Example result: `-4.870637512E+01,-4.746300888E+01,-6.188836670E+01,...`

:FETCh:AD[:METRics]:PACKet:POWer? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:PACKet:POWer?`
Example:	`:FETC:AD:PACK:POW?`
Notes:	Return the RMS power of the detected packet in dBm. Example result: `9.9998E+00`

:FETCh:AD[:METRics]:PACKet:POWer:PEAK? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:PACKet:POWer:PEAK?`
Example:	`:FETC:AD:PACK:POW:PEAK?`
Notes:	Return the Peak Power of the detected packet in dBm Example result: `1.2067E+01`

:FETCh:AD[:METRics]:PACKet:POWer:PEAK:TIME? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:PACKet:POWer:PEAK:TIME?`
Example:	`:FETC:AD:PACK:POW:PEAK:TIME?`
Notes:	Return the position of detected peak power in time domain, in seconds. Example result: `1.1409E-05`

:FETCh:AD[:METRics]:PACKet:TIME? query

User Interface:	(Command only)
Command:	`:FETCh:AD[:METRics]:PACKet:TIME?`
Example:	`:FETC:AD:PACK:TIME?`
Notes:	Returns the start time and end time of the detected packet, as a pair of comma-separated values. Example result: `2.0000E-06,1.3236E-05`

:FETCh:AD:PERRor query

User Interface:	(Command only)
Command:	`:FETCh:AD:PERRor?`
Example:	`:FETC:AD:PERR?`
Notes:	Return the results of the 802.11ad Phase Error measurement, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:PSETtling query

User Interface:	(Command only)
Command:	`:FETCh:AD:PSETtling?`
Example:	`:FETC:AD:PSET?`
Notes:	Return the results of the 802.11ad Phase Settling measurement, in rad, as a comma-separated list of ASCII values.

:FETCh:AD:PVTime queries

:FETCh:AD:PVTime:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:AD:PVTime:LINear?`
Example:	`:FETC:AD:PVT:LIN?`
Notes:	Return the linear magnitude of the 802.11ad Power vs Time measurement, in Vpk, as a comma-separated list of ASCII values.

:FETCh:AD:PVTime:LOGarithmic? query

User Interface:	(Command only)
Command:	`:FETCh:AD:PVTime:LOGarithmic?`
Example:	`:FETC:AD:PVT:LOG?`
Notes:	Return the logarithmic magnitude of the 802.11ad Power vs Time measurement, in dBm, as a comma-separated list of ASCII values.

:FETCh:AD:RAMP:TIME Queries

:FETCh:AD:RAMP:TIME? query

User Interface:	(Command only)
Command:	`:FETCh:AD:RAMP:TIME[:ALL]?`
Example:	`:FETC:AD:RAMP:TIME?`
Notes:	Returns the Transmit Ramp up time and Transmit Ramp down time, in seconds, as a pair of comma-separated values. Example result: `7.5758E-10,3.7879E-10`

:FETCh:AD:RAMP:TIME:DOWN? query

User Interface:	(Command only)
Command:	`:FETCh:AD:RAMP:TIME:DOWN?`
Example:	`:FETC:AD:RAMP:TIME:DOWN?`
Notes:	Returns the Transmit Ramp down time, in seconds. Example result: `3.7879E-10`

:FETCh:AD:RAMP:TIME:UP? query

User Interface:	(Command only)
Command:	`:FETCh:AD:RAMP:TIME:UP?`
Example:	`:FETC:AD:RAMP:TIME:UP?`
Notes:	Returns the Transmit Ramp up time, in seconds. Example result: `7.5758E-10`

:FETCh:CHPower Queries

:FETCh:CHPower query

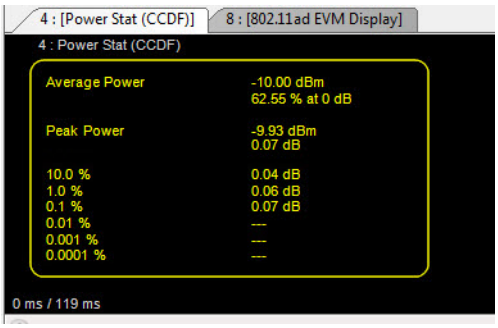
User Interface:	(Command only)
Command:	`:FETCh:CHPower?`
Example:	`:FETC:CHP?`
Notes:	Return the magnitude of the Channel Power measurement, in dBm. Example result: `7.272120905E+00`

:FETCh:CHPower:SWEep? query

User Interface:	(Command only)
Command:	`:FETCh:CHPower:SWEep?`
Example:	`:FETC:CHP:SWE?`
Notes:	Returns the result of the Point Sweep measurement as a comma separated list of values. One value per `SENSe:SWEep:POINt` count. Example result: `9.91E+37`

:FETCh:PSTatistic[METRics] query

User Interface:	Power Stat (CCDF) window results
Command:	`:FETCh:PSTatistic[:METRics]?`
Example:	`:FETC:PST?`
Notes:	Return the results of the Power Stat (CCDF) measurement, as a comma-separated list of ten values. The values are equivalent to the displayed data for the measurement:



:FETCh:PSTatistic:POWer query

User Interface:	(Command only)
Command:	`:FETCh:PSTatistic:POWer?`
Example:	`:FETCh:PST:POW?`
Notes:	Returns a series of 5001 floating point numbers (in percent) that represent the current measured Power Stat (CCDF) trace. This is the probability at particular power levels (average power), in the following order: 1. Probability at 0.0 dB power 2. Probability at 0.01 dB power 3. Probability at 0.02 dB power ... 5000. Probability at 49.9 dB power 5001. Probability at 50.0 dB power Example result:`6.177297211E+01,3.801081085E+01,2.713513374E+01, 1.842162132E+01,1.098378372E+01,5.383783817E+00,1.924324393E+00, [etc.]`

:FETCh:SEMask:CARRier:PEAK query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:CARRier:PEAK?`
Example:	`:FETC:SEM:CARR:PEAK?`
Notes:	Returns the power level and frequency at the point of peak power, as a comma-separated pair of values in dBm and Hz. Example result: `-1.317631245E+01,2.339550000E+09`

:FETCh:SEMask:OFFSet Queries

:FETCh:SEMask:OFFSet? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet[:ALL]?`
Example:	`:FETC:SEM:OFFS:ALL?`
Notes:	Return the minimal margin level, frequency and relative amplitude to the limit in all offsets. For each offset, the following three values are returned: minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr. The values are listed in this order: negative A, positive A, negative B, positive B, negative C, positive C, negative D, positive D.

:FETCh:SEMask:OFFSet:NEGative:A? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:NEGative:A?`
Example:	`:FETC:SEM:OFFS:NEG:A?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for negative offset A.

:FETCh:SEMask:OFFSet:NEGative:B? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:NEGative:B?`
Example:	`:FETC:SEM:OFFS:NEG:B?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for negative offset B.

:FETCh:SEMask:OFFSet:NEGative:C? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:NEGative:C?`
Example:	`:FETC:SEM:OFFS:NEG:C?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for negative offset C.

:FETCh:SEMask:OFFSet:NEGative:D? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:NEGative:D?`
Example:	`:FETC:SEM:OFFS:NEG:D?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for negative offset D.

:FETCh:SEMask:OFFSet:POSitive:A? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:POSitive:A?`
Example:	`:FETC:SEM:OFFS:POS:A?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for positive offset A.

:FETCh:SEMask:OFFSet:POSitive:B? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:POSitive:B?`
Example:	`:FETC:SEM:OFFS:POS:B?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for positive offset B.

:FETCh:SEMask:OFFSet:POSitive:C? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:POSitive:C?`
Example:	`:FETC:SEM:OFFS:POS:C?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for positive offset C.

:FETCh:SEMask:OFFSet:POSitive:D? query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:OFFSet:POSitive:D?`
Example:	`:FETC:SEM:OFFS:POS:D?`
Notes:	Return the minimum margin level in dBm, frequency in Hz, and relative amplitude in dBr for positive offset D.

:FETCh:SEMask:SPAN query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:SPAN?`
Example:	`:FETC:SEM:SPAN?`
Notes:	Returns the span of the Transmit Mask measurement, as a single value in Hz. Example result: `6.1309E+09`

:FETCh:SEMask:SPECtrum query

User Interface:	(Command only)
Command:	`:FETCh:SEMask:SPECtrum?`
Example:	`:FETC:SEM:SPEC?`
Notes:	Return the measured spectrum data in dBm, as a comma-separated list of ASCII values. Could be a huge complex list of results.

:FETCh:SPECtrum:MAGNitude query

User Interface:	(Command only)
Command:	`:FETCh:SPECtrum:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:SPEC:MAGN?`
Notes:	Return the measured spectrum data. Note that the returned spectrum data is centered on the center frequency. (The returned data is what is seen in the spectrum displays.) The number of points returned is always 1001. Example result: `-2.947003365E+01,-3.225088882E+01,-2.851996803E+01,...`

:FETCh:TDPower queries

:FETCh:TDPower:PEAK? query

User Interface:	(Command only)
Command:	`:FETCh:TDPower:PEAK?`
Example:	`:FETC:TDP:PEAK?`
Notes:	Get the peak point of the time domain power measurement, as a comma-separated pair of values representing absolute power (in dBm) and time.

:FETCh:TDPower[:RMS]? query

User Interface:	(Command only)
Command:	`:FETCh:TDPower[:RMS]?`
Example:	`:FETC:TDP?`
Notes:	Get the mean power of the time domain power measurement.

:FETCh:TIME Queries

:FETCh:TIME:I? query

User Interface:	(Command only)
Command:	`:FETCh:TIME:I?`
Example:	`:FETC:TIME:I?`
Notes:	Return the I component of the Main Time data, in Vpk, as a comma-separated list of ASCII values.

:FETCh:TIME:IQ? query

User Interface:	(Command only)
Command:	`:FETCh:TIME:IQ?`
Example:	`:FETC:TIME:IQ?`
Notes:	Return the I and Q component of the Main Time Data, in Vpk, as a comma-separated list of ASCII values. The I and Q data are interleaved.

:FETCh:TIME:MAGNitude:LINear? query

User Interface:	(Command only)
Command:	`:FETCh:TIME:MAGNitude:LINear?`
Example:	`:FETC:TIME:MAGN:LIN?`
Notes:	Return the linear magnitude of the Main Time data, in Vpk, as a comma-separated list of ASCII values.

:FETCh:TIME:MAGNitude[:LOGarithmic]? query

User Interface:	(Command only)
Command:	`:FETCh:TIME:MAGNitude[:LOGarithmic]?`
Example:	`:FETC:TIME:MAGN?`
Notes:	Return the logarithmic magnitude of the Main Time data, in dBm, as a comma-separated list of ASCII values.

:FETCh:TIME:PHASe? query

User Interface:	(Command only)
Command:	`:FETCh:TIME:PHASe?`
Example:	`:FETC:TIME:PHAS?`
Notes:	Return the wrapped phase component of the Main Time data, in rad, as a comma-separated list of ASCII values.

:FETCh:TIME:Q? query

User Interface:	(Command only)
Command:	`:FETCh:TIME:Q?`
Example:	`:FETC:TIME:Q?`
Notes:	Return the Q data component of the Main Time data, in Vpk, as a comma-separated list of ASCII values.

:FETCh:TIME:UPHase? query

User Interface:	(Command only)
Command:	`:FETCh:TIME:UPHase?`
Example:	`:FETC:TIME:UPH?`
Notes:	Return the unwrapped phase component, in rad, as a comma-separated list of ASCII values.

:FORMat command

User Interface:	(Command only)
Command:	`:FORMat[:TRACe][:DATA] ASCii|INTeger,32|REAL,32|REAL,64`
Example:	`:FORM ASC`
Notes:	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.

:HCOPy Commands

:HCOPy:ABORt command

User Interface:	(Command only)
Command:	`:HCOPy:ABORt`
Example:	`:HCOP:ABOR`
Notes:	Abort the print operation now in progress (the print operation may complete anyway, if enough data has already been transmitted).

:HCOPy[:IMMediate] command

User Interface:	(Command only)
Command:	`:HCOPy[:IMMediate]`
Example:	`:HCOP`
Notes:	Print the selected display to the default printer.

:INITiate Commands

:INITiate:CONTinuous command

User Interface:	Acquisition Settings > Data Acquire > Continuous Measurement
Command:	`:INITiate:CONTinuous OFF|ON|0|1` `:INITiate:CONTinuous?`
Example:	`:INIT:CONT ON`
Notes:	Enable continuous mode (measurement will run continuously) or disable it (measurement will stop after one cycle). This feature is enabled by default. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:INITiate[:IMMediate] command

User Interface:	(Command only)
Command:	`:INITiate[:IMMediate]`
Example:	`:INIT`
Notes:	Start the measurement running.

:INITiate:PAUSe command

User Interface:	(Command only)
Command:	`:INITiate:PAUSe`
Example:	`:INIT:PAUS`
Notes:	Stop the measurement running.

:INPut Commands

:INPut:CHANnel1|CHANnel:RANGe command

User Interface:	Acquisition Settings > Data Acquire > Range
Command:	`:INPut:CHANnel1|CHANnel:RANGe <numeric value>` `:INPut:CHANnel1|CHANnel:RANGe?`
Example:	`:INP:CHAN1|CHAN:RANG -10`
Notes:	Set or get the input range in dBm. Range: -50 to +20. Default: 0.

:INPut:DATA:FEED command

User Interface:	Acquisition Settings > Misc > Data From
Command:	`:INPut:DATA:FEED HARDware|RECording` `:INPut:DATA:FEED?`
Example:	`:INP:DATA:FEED REC`
Notes:	Sets the acquisition input as data from instrument hardware or recording. This feature requires license E7760A-RFP.

:INPut:RANGe:AUTO command

User Interface:	(Command only)
Command:	`:INPut:RANGe:AUTO`
Example:	`:INP:RANG:AUTO`
Notes:	Adjust the attenuation and gain so that clipping of the input signal is minimized. This adjustment is performed once, when the command is issued, so the adjustment is based on whatever the measured input level is at that time.

:INPut:RANGe:AUTO:MARGin command

User Interface:	Acquisition Settings > Data Acquire > Auto-Range Margin
Command:	`:INPut:RANGe:AUTO:MARGin <numeric value in dB>` `:INPut:RANGe:AUTO:MARGin?`
Example:	`:INP:RANG:AUTO:MARG -1.5 dB`
Notes:	Applies an offset to the Auto Range process; a positive value gives more margin for input signals that tend to over-range, a negative value provides improved dynamic range for input signals that are stable in power level. The range is -10 dB to +10 dB. The default value is 0 dB.

:INPut:RECording:NAME command

User Interface:	Acquisition Settings > Misc > Recording File Name
Command:	`:INPut:RECording:NAME <filename.csv>` `:INPut:RECording:NAME?`
Example:	`:INP:REC:NAME "Data/IQData.csv"`
Notes:	Selects an IQ Data recording for analysis when `INPut:DATA:FEED` is set to `RECording`. The recording file is to be from a prior Save IQ Data operation. This feature requires license E7760A-RFP.

:MMEMory Commands

:MMEMory:CATalog? query

User Interface:	(Command only)
Command:	`:MMEMory:CATalog? <directory_name>`
Example:	`:MMEM:CAT? "C:/Test"`
Notes:	Queries disk usage information (drive capacity, free space available) and obtains a list of files and directories in a specified directory in the following format: <numeric_value>,<numeric_value>,{<file_entry>} (The string must be a valid logical path.) The query returns two numeric parameters and as many strings as there are files and directories. The first parameter indicates the total amount of storage currently used in bytes. The second parameter indicates the total amount of storage available, also in bytes. The <file_entry> is a string. Each <file_entry> indicates the name, type, and size of one file in the directory list: <file_name>,<file_type>,<file_size> As the 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. For directories, <file_entry> is surrounded by square brackets and both <file_type> and <file_size> are empty

:MMEMory:CDIRectory command

User Interface:	(Command only)
Command:	`:MMEMory:CDIRectory [<directory name>]` `:MMEMory:CDIRectory?`
Example:	`:MMEM:CDIR "C:/Test"`
Notes:	Change the default directory for a mass memory file system. The <directory_name> parameter is a string. The string must be a valid logical path. 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. The query returns the full path of the default directory.

:MMEMory:COPY command

User Interface:	(Command only)
Command:	`:MMEMory:COPY <string>,<string>[,<string>,<string>]`
Example:	`:MMEM:COPY "C:/Test/file1","C:/Test/file2"`
Notes:	Copies an existing file to a new file or an existing directory to a new directory. The string must be a valid logical path. 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. This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

:MMEMory:DATA command

User Interface:	(Command only)
Command:	`:MMEMory:DATA <file_name>, <data>` `:MMEMory:DATA?`
Example:	`:MMEM:DATA "C:/Test/file1", 16` `:MMEM:DATA? "C:Test/file1"`
Notes:	The command loads the specified data (in 488.2 block format) into the named file (the file must be a valid logical path). The query returns the data from the file in block format.

:MMEMory:DATA:APPEND command

User Interface:	(Command only)
Command:	`:MMEMory:DATA:APPEND <filename>, <blockdata>`
Example:	`:MMEM:DATA:APPEND "C:/Test/file1", 16`
Notes:	The command appends byte data to an existing file stored in memory. The <blockdata> parameter represents the file length and the data to be appended.

:MMEMory:DELete command

User Interface:	(Command only)
Command:	`:MMEMory:DELete <file_name>[,<directory name>]`
Example:	`:MMEM:DEL "file1","C:/Test"`
Notes:	Removes a file from the specified directory. The <file_name> parameter specifies the file name to be removed. This command will generate an "access denied" error if the file is in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

:MMEMory:LOAD:CORRection:CSET command

User Interface:	System > Path Loss Configuaration >Import
Command:	`:MMEMory:LOAD:CORRection:CSET[1]|2|3...8 <filename>`
Example:	`:MMEM:LOAD:CORR:CSET1 "C:\TEMP\amp.txt"`
Notes:	Load the specified correction table from the specified file (the file must be a valid logical path).

:MMEMory:LOAD:STATe command

User Interface:	File > Recall State
Command:	`:MMEMory:LOAD:STATe <filename>`
Example:	`:MMEM:LOAD:STAT "C:/Payloads/July29.state"`
Notes:	Load the named state file.

:MMEMory:MDIRectory comand

User Interface:	(Command only)
Command:	`:MMEMory:MDIRectory <directory_name>`
Example:	`:MMEM:MDIR "C:/Test/dir1"`
Notes:	Create a directory. The string must be a valid logical path. This command will generate an “access denied” error if the file is in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

:MMEMory:MOVE command

User Interface:	(Command only)
Command:	`:MMEMory:MOVE <string>,<string>[,<string>,<string>]`
Example:	`:MMEM:MOVE "C:/dir1/file1", "C:/dir2/file2"`
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. This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

:MMEMory:RDIRectory command

User Interface:	(Command only)
Command:	`:MMEMory:RDIRectory <directory_name>`
Example:	`:MMEM:RDIR "C:/dir1"`
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. This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

:MMEMory:STORe:CORRection:CSET command

User Interface:	System > Path Loss Configuaration >Export
Command:	`:MMEMory:STORe:CORRection:CSET[1]|2|3...8 <filename>`
Example:	`:MMEM:STOR:CORR:CSET2 "C:\TEMP\amp.txt"`
Notes:	Stores the specified correction table to the specified file (the file must be a valid logical path).

:MMEMory:STORe:DISPlay:IMAGe command

User Interface:	Measurement display > right-click popup menu > Save Image As
Command:	`:MMEMory:STORe:DISPlay:IMAGe <displayname>,<filename>`
Example:	`:MMEM:STOR:DISP:IMAG "802.11ad EVM Display", "C:\Temp\evm1.png"`
Notes:	Save a screen capture image of the specified measurement display window in the specified location. Make sure that the measurement display window is sized properly to show all of the information it contains; the saved image will not add any details that are hidden by the current window sizing. Available window names are: "Main Time", "Spectrum", "Transmit Mask", "802.11ad Error Summary", "802.11ad Decoded Data", "802.11ad Codeword Display", "802.11ad EVM Display", "802.11ad Correlator Output", "802.11ad Channel Estimation", "802.11ad Channel Frequency Response", "802.11ad IQ Data", "802.11ad EVM Spectrum".

:MMEMory:STORe:DISPlay:IMAGe:SCReen command

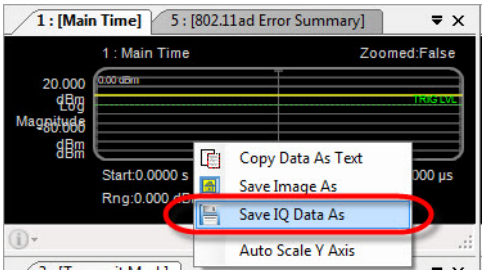
User Interface:	File > Save Screen
Command:	`:MMEMory:STORe:DISPlay:IMAGe:SCReen <filename>`
Example:	`:MMEM:STOR:DISP:IMAG:SCR "C:\Temp\scr1.png"`
Notes:	Save a screen capture image of the entire screen in the specified location.

:MMEMory:STORe:STATe command

User Interface:	File > Save State...
Command:	`:MMEMory:STORe:STATe [<numeric_value>], <quoted_string>`
Example:	`:MMEM:STOR:STAT "MyStateFile.state"`
Notes:	Stores the current instrument state data in the named file in the default directory. <numeric_value> is included for backwards compatibility, and is ignored?

:MMEMory:STORe:TIME:IQ command

User Interface:	(Right-click menu within Main Time window)
Command:	`:MMEMory:STORe:TIME:IQ <filename>`
Example:	`:MMEM:STOR:TIME:IQ "C:\Temp\IQData.csv"`

Notes:	This is equivalent to the right-click menu item "Save IQ Data As" in the Main Time window. The data values are saved as a file of comma -separated values in the named file location.
	See also:
	`:INPut:DATA:FEED`
	`:INPut:RECording:NAME`
	 

:OUTPut:ARB Commands

:OUTPut:ARB:MDEStination:PULSe command

User Interface:	Current Output Device Settings > Dual ARB Marker Utilities > Pulse/RF Blanking
Command:	`:OUTPut:ARB:MDEStination:PULSe NONE|M1|M2|M3|M4` `:OUTPut:ARB:MDEStination:PULSe?`
Example:	`:OUTP:ARB:MDES:PULS M2`
Notes:	Select the Pulse/RF Blanking marker routing (Marker 1, 2, 3, 4, or None).

:OUTPut:ARB:MDEStination:TRIGger command

User Interface:	Current Output Device Settings > Dual ARB Marker Utilities > Trigger Output
Command:	`:OUTPut:ARB:MDEStination:TRIGger NONE|M1|M2|M3|M4` `:OUTPut:ARB:MDEStination:TRIGger?`
Example:	`:OUTP:ARB:MDES:TRIG M4`
Notes:	Select the Trigger Output marker routing (Marker 1, 2, 3, 4, or None).

:OUTPut:ARB:MPOLarity:MARKer command

User Interface:	Current Output Device Settings > Dual ARB Marker Utilities > Marker *n* Polarity
Command:	`:OUTPut:ARB:MPOLarity:MARKer[1]|2|3|4: POSitive|NEGative` `:OUTPut:ARB:MPOLarity:MARKer[1]|2|3|4?`
Example:	`:OUTP:ARB:MPOL:MARK2 POS`
Notes:	Set the polarity of the specified marker as positive or negative.

:OUTPut:ARB:TRIGger:OUTPut command

User Interface:	Current Output Device Settings > Dual ARB Marker Utilities > Trigger Output Type
Command:	`:OUTPut:ARB:TRIGger:OUTPut INT|EXT2` `:OUTPut:ARB:TRIGger:OUTPut?`
Example:	`:OUTP:ARB:TRIG:OUTP EXT2`
Notes:	Set the trigger output type (Internal or External 2). If External 2 is selected, the marker output is supplied to the TRIG 2 connector on the E7760A rear panel. The default setting is Internal.

:OUTPut:DEVice Commands

:OUTPut:DEVice:ARB:ACTive query

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:ARB:ACTive?`
Example:	`:OUTP:DEV:ARB:ACT?`
Notes:	Returns the name of the waveform currently playing in ARB memory. If ARB memory contains a waveform from a **Generate and Output** operation, the return value will be “EMPTY”.

:OUTPut:DEVice:ARB:DELete command

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:ARB:DELete <"WaveformName">`
Example:	`:OUTP:DEV:ARB:DEL "WF2"`
Notes:	This will delete the specified waveform from ARB memory. This will be necessary if an "out of memory" error occurs during an `:OUTPut:DEVice:NRUN` call.

:OUTPut:DEVice:ARB:DELete:ALL command

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:ARB:DELete:ALL`
Example:	`:OUTP:DEV:ARB:DEL:ALL`
Notes:	This will delete all the waveforms from ARB memory.

:OUTPut:DEVice:ARB:LIST query

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:ARB:LIST?`
Example:	`:OUTP:DEV:ARB:LIST?`
Notes:	Returns a comma-separated list of waveform names in ARB memory. The return value will be "Empty" if no waveform names are in ARB memory.

:OUTPut:DEVice:ARB:LOAD command

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:ARB:LOAD <"filename.txt">`
Example:	`:OUTP:DEV:ARB:LOAD "Wavefiles/waveform.txt"`

Notes:	Loads a user-supplied waveform ARB memory and begins generator playback. **Generate and Output** must not be invoked as it will supplant the user-supplied waveform with a waveform based on the **Final Waveform** settings.
	
	The user-supplied waveform must be a .txt file, providing the data values in this exact format:
	`Sample interval`
	`Idata Qdata`
	`Idata Qdata`
	`:`
	
	Restrictions:
	The sample interval must be 3.78787878787879E-10.
	Both I and Q must be floating point values between -1.0 and 1.0.
	
	Example .txt file:
	`3.78787878787879E-10`
	`0.006711463 -0.0001927024`
	`0.008302763 0.002163386`
	`0.002517175 0.001371499`
	`0.005333942 0.004120519`
	`0.003596609 0.005023811`
	`0.006991484 -0.0001535597`
	`0.006664793 0.00137451`
	`0.002024881 0.001488927`
	
	This feature requires license E7760A-CG1.

:OUTPut:DEVice:CATalog? query

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:CATalog?`
Example:	`:OUTP:DEV:CAT?`
Notes:	This query returns a comma-separated list containing all licensed output devices. These can be passed to `OUTPut:DEVice:SELect`.

:OUTPut:DEVice:NRUN command

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:NRUN <"waveformName">` `:OUTPut:DEVice:NRUN?`
Example:	`:OUTP:DEV:NRUN "MCS3"`
Notes:	Runs the **Generate & Output** function and saves the waveform in ARB memory under the name you specify.

:OUTPut:DEVice:RUN command

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:RUN`
Example:	`:OUTP:DEV:RUN`
Notes:	This command builds and downloads the waveform to the E7760A signal source.

:OUTPut:DEVice:RUN:NPENding command

User Interface:	(Command only)
Command:	`:OUTPut:DEVice:RUN:NPENding`
Example:	`:OUTP:DEV:RUN:NPEN`
Notes:	This command is similar to the `:OUTPut:DEVice:RUN` command described above, except that the command will not block the SCPI connection. The user should query the status bit (Bit 8) by sending `STATus:OPERation:CONDition?` to find out of if the waveform generation and downloading is finished or not.

:OUTPut:DEVice[:SELect] command

User Interface:	(Command only)
Command:	`:OUTPut:DEVice[:SELect]` `:OUTPut:DEVice[:SELect]?`
Example:	`:OUTPut:DEV`
Notes:	This command will specify the current output device. The available choices depend on installed licenses and valid choices can be listed using `OUTPut:DEVice:CATalog?`

:OUTPut:FREQuency command

User Interface:	Current Output Device Settings > Source Configurations > Frequency
Command:	`:OUTPut:FREQuency <freq>` `:OUTPut:FREQuency?`
Example:	`:OUTP:FREQ 58 GHz`
Notes:	Set the output frequency, in Hz. If the Output Port is IF IO 1 or IF IO 2 (see the `:SENSe:FEED:PORT:OUTPut` command) the default value is 3 GHz and the range is 2 to 18 GHz. For other Output Port settings, the default value is 60 GHz and the range is 55 GHz to 68 GHz.

:OUTPut:MODulation command

User Interface:	Current Output Device Settings > Source Configurations > Modulation On
Command:	`:OUTPut:MODulation[:STATe] OFF|ON|0|1` `:OUTPut:MODulation[:STATe]?`
Example:	`:OUTP:MOD ON`
Notes:	If enabled, the output signal will be modulated. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:OUTPut:NOISe Commands

:OUTPut:NOISe:CNRatio command

User Interface:	Final Waveform Settings > Noise Settings > C/N Ratio
Command:	`:OUTPut:NOISe:CNRatio <dB>` `:OUTPut:NOISe:CNRatio?`
Example:	`:OUTP:NOIS:CNR 24`
Notes:	Set or get the carrier to noise ratio that is applied to the signal in the measurement bandwidth. The range is -20 to 90 dB. The default selection is 21 dB. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:DC:I command

User Interface:	Final Waveform Settings > IQ Distortions > DC Offset on I
Command:	`:OUTPut:NOISe:IMPairments:DC:I <numeric value>` `:OUTPut:NOISe:IMPairments:DC:I?`
Example:	`:OUTP:NOIS:IMP:DC:I -3`
Notes:	Set or get the DC offset present on the real axis, expressed as a fraction of 1.0 = constellation axis magnitude. The range is -100 to +100. The default selection is 0. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:DC:Q command

User Interface:	Final Waveform Settings > IQ Distortions > DC Offset on Q
Command:	`:OUTPut:NOISe:IMPairments:DC:Q <numeric value>` `:OUTPut:NOISe:IMPairments:DC:Q?`
Example:	`:OUTP:NOIS:IMP:DC:Q 3`
Notes:	The DC offset present on the imaginary axis, expressed as a fraction of 1.0 = constellation axis magnitude. The range is -100 to +100. The default selection is 0. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:EXPonent:I command

User Interface:	Final Waveform Settings > IQ Distortions > I Exponent
Command:	`:OUTPut:NOISe:IMPairments:EXPonent:I <numeric value>` `:OUTPut:NOISe:IMPairments:EXPonent:I?`
Example:	`:OUTP:NOIS:IMP:EXP:I 2`
Notes:	The I value is raised to this power before being subject to the other distortions. (Sign is preserved.) The range is 0 to 10. The default selection is 1. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:EXPonent:Q command

User Interface:	Final Waveform Settings > IQ Distortions > Q Exponent
Command:	`:OUTPut:NOISe:IMPairments:EXPonent:Q <numeric value>` `:OUTPut:NOISe:IMPairments:EXPonent:Q?`
Example:	`:OUTP:NOIS:IMP:EXP:Q 3`
Notes:	The Q value is raised to this power before being subject to the other distortions. (Sign is preserved.) The range is 0 to 10. The default selection is 1. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:GAIN:I command

User Interface:	Final Waveform Settings > IQ Distortions > Gain on I
Command:	`:OUTPut:NOISe:IMPairments:GAIN:I <numeric value>` `:OUTPut:NOISe:IMPairments:GAIN:I?`
Example:	`:OUTP:NOIS:IMP:GAIN:I 10`
Notes:	The linear gain on I. The range is -100 to +100. The default selection is 1. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:GAIN:Q command

User Interface:	Final Waveform Settings > IQ Distortions > Gain on Q
Command:	`:OUTPut:NOISe:IMPairments:GAIN:Q <numeric value>` `:OUTPut:NOISe:IMPairments:GAIN:Q?`
Example:	`:OUTP:NOIS:IMP:GAIN:Q 5`
Notes:	The linear gain on Q. The range is -100 to +100. The default selection is 1. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:IQConj command

User Interface:	Final Waveform Settings > IQ Distortions > IQ Conjugation
Command:	`:OUTPut:NOISe:IMPairments:IQConj NORM|INV|SWAP` `:OUTPut:NOISe:IMPairments:IQConj?`
Example:	`:OUTP:NOIS:IMP:IQC INV`
Notes:	Determines whether Q and Q will be output normally, or the Q values will be inverted, or the I and Q values will be swapped. The default selection is Normal. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:QERRor command

User Interface:	Final Waveform Settings > IQ Distortions > IQ Quadrature Error
Command:	`:OUTPut:NOISe:IMPairments:QERRor <degrees>` `:OUTPut:NOISe:IMPairments:QERRor?`
Example:	`:OUTP:NOIS:IMP:QERR 45`
Notes:	The deviation from perfect quadrature in the I and Q axis, in degrees. The range is -360 to +360. The default selection is 0. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:PMODulation:AMPLitude command

User Interface:	Final Waveform Settings > Phase Modulation > Peak Amplitude
Command:	`:OUTPut:NOISe:IMPairments:PMODulation:AMPLitude <degrees>` `:OUTPut:NOISe:IMPairments:PMODulation:AMPLitude?`
Example:	`:OUTP:NOIS:IMP:PMOD:AMPL 10`
Notes:	This impairment applies sinusoidal phase modulation to the waveform. This sets the peak phase rotation. For example, with the value set to 20°, a constellation point at 0° will oscillate sinusoidally between +20° and -20°. The range is -360 to +360. The default selection is 0. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:PMODulation:FREQuency command

User Interface:	Final Waveform Settings > Phase Modulation > Modulation Frequency
Command:	`:OUTPut:NOISe:IMPairments:PMODulation:FREQuency <Hz>` `:OUTPut:NOISe:IMPairments:PMODulation:FREQuency?`
Example:	`:OUTP:NOIS:IMP:PMOD:FREQ 1 MHz`
Notes:	The frequency of the sinusoidal phase modulation. The range is 0 Hz to 100 MHz. The default selection is 0 Hz. This feature requires license E7760A-CG1.

:OUTPut:NOISe:IMPairments:SKEW command

User Interface:	Final Waveform Settings > Skew > Skew
Command:	`:OUTPut:NOISe:IMPairments:SKEW <s>` `:OUTPut:NOISe:IMPairments:SKEW?`
Example:	`:OUTP:NOIS:IMP:SKEW 10 ns`
Notes:	Enter the skew value in seconds (specify ns to use whole numbers). If this is set to a non-zero value, the real and imaginary parts of the waveform are generated with a time skew between them. If the skew value is positive, the real component will lead the imaginary; if the skew value is negative, the real component will lag the imaginary. Skew is applied on a per-segment basis, so if there are discontinuities between segments, skew can make this more pronounced. The range is -10 to +10 ns. The default selection is 0. See SCPI command `:OUTPut:NOISe:IMPairments:SKEW` This feature requires license E7760A-CG1.

:OUTPut:NOISe:NONLy command

User Interface:	Final Waveform Settings > Noise Settings > Noise Only
Command:	`:OUTPut:NOISe:NONLy 0|1` `:OUTPut:NOISe:NONLy?`
Example:	`:OUTP:NOIS:NONL 1`
Notes:	Set to 1 for True, 0 for False. When noise generation is enabled (see the `:OUTPut:NOISe[:STATe]` command) and this is True, the waveform file will contain noise only; at the same power level it would have were the signal also present. This allows you to measure the in-band power level directly. False is the default selection. This feature requires license E7760A-CG1.

:OUTPut:NOISe:OBWidth command

User Interface:	Final Waveform Settings > Noise Settings > Measurement Bandwidth
Command:	`:OUTPut:NOISe:OBWidth <Hz>` `:OUTPut:NOISe:OBWidth?`
Example:	`:OUTP:NOIS:OBW 1.2 GHz`
Notes:	This is the bandwidth in which the carrier to noise ratio is measured. Normally, this should be set to match the occupied bandwidth of the signal. Specify the value in GHz to use smaller numbers. The range is 0 Hz to 100 GHz. The default selection is 1.8 GHz. This feature requires license E7760A-CG1.

:OUTPut:NOISe[:STATe] command

User Interface:	Final Waveform Settings > Noise Settings > Noise On
Command:	`:OUTPut:NOISe[:STATe] 0|1` `:OUTPut:NOISe[:STATe]?`
Example:	`:OUTP:NOIS 1`
Notes:	Specify 0 for False or 1 for True. If true, noise is added to the generated waveform file at the specified C/N ratio as measured in the specified measurement bandwidth. False is the default selection. This feature requires license E7760A-CG1.

:OUTPut:PLAY Commands

:OUTPut:PLAY command

User Interface:	(Command only)
Command:	`:OUTPut:PLAY[:INITiate]`
Example:	`:OUTP:PLAY`
Notes:	Re-Initiate the source based on the current configuration. Interrupt any waveform that is currently playing and start over.

:OUTPut:PLAY:COUNt command

User Interface:	Current Output Device Settings > Source Configurations > Play Count
Command:	`:OUTPut:PLAY:COUNt <count>` `:OUTPut:PLAY:COUNt?`
Example:	`:OUTP:PLAY:COUN 575`
Notes:	Set the number of times the waveform is to be played (if the waveform play mode is "By Count"). Range: 1 to 100,000,000. Default: 1000.

:OUTPut:PLAY:MODE command

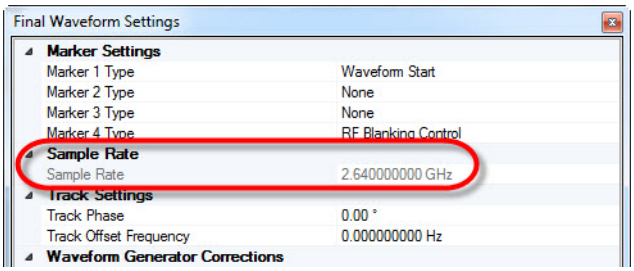
User Interface:	Current Output Device Settings > Source Configurations > Play Mode
Command:	`:OUTPut:PLAY:MODE COUNt|CONTinuous` `:OUTPut:PLAY:MODE?`
Example:	`:OUTP:PLAY:MODE COUN`
Notes:	Set the output device waveform playing mode as "By Count" or "Continuous".

:OUTPut:POWer command

User Interface:	Current Output Device Settings > Source Configurations > Amplitude
Command:	`:OUTPut:POWer[:AMPLitude] <ampl>` `:OUTPut:POWer[:AMPLitude]?`
Example:	`:OUTP:POW -10`
Notes:	Set the source output power level in dBm. Range: -70 to +10. Default: -20.

:OUTPUT:SRATe Query

User Interface:	Final Waveform Settings > Sample Rate > Sample Rate
Command:	`:OUTPut:SRATe?`
Example:	`:OUTP:SRAT?`
Notes:	Returns the Sample Rate, as displayed in the Final Waveform Settings window. (This is not a settable parameter, so the command is query-only.)



:OUTPut:STATe command

User Interface:	Current Output Device Settings > Source Configurations > Output On
Command:	`:OUTPut:STATe OFF|ON|0|1` `:OUTPut:STATe?`
Example:	`:OUTP:STAT ON`
Notes:	Enable or disable output power from the source. It is necessary to turn the output off to make changes to the 802.11ad segment; after making the changes, select Generate and Output, then turn the output on again. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state. The output is enabled by default.

:SENSe:AVERage Commands

:SENSe:AVERage:COUNt command

User Interface:	Acquisition Settings > Average > Average Count
Command:	`:SENSe:AVERage:COUNt <count>` `:SENSe:AVERage:COUNt?`
Example:	`:SENS:AVER:COUN 12`
Notes:	Set the count for measurement averaging (the setting has no effect if averaging is not enabled; see the `:SENSe:AVERage[:STATe]` command). Range: 1 to 50. Default: 10.

:SENSe:AVERage[:STATe] command

User Interface:	Acquisition Settings > Average > Average State On
Command:	`:SENSe:AVERage[:STATe] OFF|ON|0|1` `:SENSe:AVERage[:STATe]?`
Example:	`:SENS:AVER ON`
Notes:	Enable or disable averaging mode (all measurements will be averaged if this is enabled). Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:CHPower Commands

:SENSe:CHPower:BANDwidth:INTegration command

User Interface:	Acquisition Settings > Measure - Channel Power > Chp Int BW
Command:	`:SENSe:CHPower:BANDwidth:INTegration <bandwidth>` `:SENSe:CHPower:BANDwidth:INTegration?`
Example:	`:SENS:CHP:BAND:INT 8 MHz`
Notes:	Specifies the range of integration used in calculating the power in the channel. The integration bandwidth (IBW) is displayed on the trace as two markers connected by an arrow. Default setting: 1 GHz. Range: 100 kHz to 1.85 GHz.

:SENSe:CHPower:FREQuency command

User Interface:	Acquisition Settings > Measure - Channel Power > Chp Freq
Command:	`:SENSe:CHPower:FREQuency` `:SENSe:CHPower:FREQuency?`
Example:	`:SENS:CHP:FREQ`
Notes:	Specify the center frequency of channel power (if the center frequency auto mode is disabled by the `:SENSe:CHPower:FREQuency:AUTO` command).

:SENSe:CHPower:FREQuency:AUTO command

User Interface:	Acquisition Settings > Measure - Channel Power > Chp Freq Auto
Command:	`:SENSe:CHPower:FREQuency:AUTO OFF|ON|0|1` `:SENSe:CHPower:FREQuency:AUTO?`
Example:	`:SENS:CHP:FREQ:AUTO`
Notes:	Enable/disable the Auto mode for channel power center frequency. If enabled (the default state), the channel power measurement will use the center frequency of the capture. If disabled, the channel power measurement will use the center frequency specified by the `:SENSe:CHPower:FREQuency` command. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:CHPower[:STATe] command

User Interface:	Acquisition Settings > Measure - Channel Power > Chp On
Command:	`:SENSe:CHPower[:STATe] OFF|ON|0|1` `:SENSe:CHPower[:STATe]?`
Example:	`:SENS:CHP ON`
Notes:	Enable/disable channel power measurement. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state. The measurement is disabled by default.

:SENSe:CORRection commands

:SENSe:CORRection:CSET:ALL:DELete command

User Interface:	System > Path Loss Configuaration >Delete All
Command:	`:SENSe:CORRection:CSET:ALL:DELete`
Example:	`SENS:CORR:CSET:ALL:DEL`
Notes:	Erase all correction values for from Amplitude Correction sets. (Although CSET is a required parameter in this command, no number value needs to be specified for it, as all correction sets are affected by the command.)

:SENSe:CORRection:CSET:ALL:OFF command

User Interface:	System > Path Loss Configuaration >Turn off All
Command:	`:SENSe:CORRection:CSET:ALL:OFF`
Example:	`SENS:CORR:CSET:ALL:OFF`
Notes:	Turn off all correction values for all Amplitude Correction sets. (Although CSET is a required parameter in this command, no number value needs to be specified for it, as all correction sets are affected by the command.)

:SENSe:CORRection:CSET:DATA command

User Interface:	System > Path Loss Configuaration >Properties > Path Loss (Collection)
Command:	`:SENSe:CORRection:CSET[1]|2|3...8:DATA <freq>, <ampl>, ...` `:SENSe:CORRection:CSET[1]|2|3...8:DATA?`
Example:	`SENS:CORR:CSET3:DATA 10e9,10,20e9,10.2,21e9,10.5,22e9,15` `SENS:CORR:CSET3:DATA?`
Notes:	Replace all values in the specified correction set with the comma-separated list of frequency and amplitude values specified. Up to 2000 points can be included in the correction set. The query returns the current values in the specified correction set.

: SENSe:CORRection:CSET:DATA:MERGe command

User Interface:	System > Path Loss Configuaration >Properties > Path Loss (Collection)
Command:	`:SENSe:CORRection:CSET[1]|2|3...8:DATA:MERGe <freq>, <ampl>, ...`
Example:	`SENS:CORR:CSET4:DATA:MERG 10e9,10,20e9,10.2,21e9,10.5, 22e9,15`
Notes:	Merge the comma-separated list of frequency and amplitude values with the values in the specified correction 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.Up to 2000 points can be included in the correction set.

: SENSe:CORRection:CSET:DELete command

User Interface:	System > Path Loss Configuaration >Delete
Command:	`:SENSe:CORRection:CSET[1]|2|3...8:DATA:DELete`
Example:	`SENS:CORR:CSET5:DEL`
Notes:	Delete all values from the specified correction set.

:SENSe:CORRection:CSET:DIRection command

User Interface:	System > Path Loss Configuaration >Properties > Direction
Command:	`:SENSe:CORRection:CSET[1]|2|3...8:DIRection BOTH|SOURce|ANALyzer` `:SENSe:CORRection:CSET[1]|2|3...8:DIRection?`
Example:	`SENS:CORR:CSET6:DIR SOUR`
Notes:	Apply the specified correction set to the outgoing signal (source), incoming signal (analyzer), or both. The query returns the current state.

:SENSe:CORRection:CSET:PORT command

User Interface:	System > Path Loss Configuaration > Properties > Port
Command:	`:SENSe:CORRection:CSET[1]|2|3...8:PORT NONE|A1|A2|A3|B1|B2|B3|IFIO1|IFIO2` `:SENSe:CORRection:CSET[1]|2|3...8:DIRection?`
Example:	`SENS:CORR:CSET7:PORT A2`
Notes:	Apply the specified correction set to the specified port. The query returns the current state.

:SENSe:CORRection:CSET:[STATe] command

User Interface:	System > Path Loss Configuaration >Properties > State
Command:	`:SENSe:CORRection:CSET[1]|2|3...8:[STATe] ON|OFF` `:SENSe:CORRection:CSET[1]|2|3...8:[STATe]?`
Example:	`SENS:CORR:CSET7 ON`
Notes:	Enable/disable the specified correction table. The query returns the current state.

:SENSe:DEModulation:AD Commands

:SENSe:DEModulation:AD:CPCTracking command

User Interface:	802.11ad Demodulation Settings > Tracking > Control PHY Carrier Tracking
Command:	`:SENSe:DEModulation:AD:CPCTracking OFF|ON|0|1` `:SENSe:DEModulation:AD:CPCTracking?`
Example:	`:SENS:DEM:AD:CPCT ON`
Notes:	Control PHY Carrier Tracking. If true, carrier tracking is applied when demodulating Control PHY packets. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:DEModulation:AD:DERotate command

User Interface:	802.11ad Demodulation Settings > Constellation Display > De-Rotate
Command:	`:SENSe:DEModulation:AD:DERotate OFF|ON|0|1` `:SENSe:DEModulation:AD:DERotate?`
Example:	`:SENS:DEM:AD:DER ON`
Notes:	De-rotate. If true, the rotated π/2-BPSK constellation points are de-rotated, if false they are left rotated. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:DEModulation:AD:EVM:LIMit:CONTrol command

User Interface:	802.11ad Demodulation Settings > EVM Limits > Control PHY: MCS0
Command:	`:SENSe:DEModulation:AD:EVM:LIMit:CONTrol <rel_amplitude>` `:SENSe:DEModulation:AD:EVM:LIMit:CONTrol?`
Example:	`:SENS:DEM:AD:EVM:LIM:CONT -7`
Notes:	The maximum permitted EVM for control physics (MCS0), in dB. If the EVM exceeds this value, the demodulation measurement will return a failure. The query returns the current state. The default value is -6.

:SENSe:DEModulation:AD:EVM:LIMit[:SCARrier]:MCS command

User Interface:	802.11ad Demodulation Settings > EVM Limits > Single Carrier: MCS1 - MCS12
Command:	`:SENSe:DEModulation:AD:EVM:LIMit[:SCARrier]:MCS[1]|2...12 <limit>` `:SENSe:DEModulation:AD:EVM:LIMit[:SCARrier]:MCS[1]|2...12?`
Example:	`:SENS:DEM:AD:EVM:LIM:MCS3 -8` `:SENS:DEM:AD:EVM:LIM:MCS3?`
Notes:	The maximum permitted EVM for single-carrier physics (MCS1 - MCS12, as specified by the MCS parameter), in dB. If the EVM exceeds this MCS-dependent value, the demodulation measurement will return a failure. The query returns the current state. The default values are dependant on the MCS number, as follows: MCS1: -6, MCS2: -7, MCS3: -9, MCS4: -10, MCS5: -12, MCS6: -11 MCS7: -12, MCS8: -13, MCS9: -15, MCS10: -19, MCS11: -20, MCS12: -21

:SENSe:DEModulation:AD:FREQuency:CORRect command

User Interface:	802.11ad Demodulation Settings > Frequency Correction > Correct Frequency
Command:	`:SENSe:DEModulation:AD:FREQuency:CORRect OFF|ON|0|1` `:SENSe:DEModulation:AD:FREQuency:CORRect?`
Example:	`:SENS:DEM:AD:FREQ:CORR ON` `:SENS:DEM:AD:FREQ:CORR?`
Notes:	Enable/disable frequency correction during demodulation measurement. If enabled, the calculated frequency error is compensated for, and a second correlation is performed, for a better EVM result. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state. The feature is enabled by default.

:SENSe:DEModulation:AD:PSEarch command

User Interface:	802.11ad Demodulation Settings > Packet Search > Packet Search Mode
Command:	`:SENSe:DEModulation:AD:PSEarch LARGest|FIRSt` `:SENSe:DEModulation:AD:PSEarch?`
Example:	`:SENS:DEM:AD:PSE LARG`
Notes:	Packet Search Mode. This sets/gets the packet search type, i.e. this determines how to pick which packet to demodulate if multiple packets are present in the time record. `LARGest` means means that the packet with the largest correlation spikes will be used. `FIRSt` means that the demodulation measurement will look for the first RF burst that exceeds the limit set by the `:SENSe:DEModulation:AD:THReshold` command. `LARGest` is the default setting.

:SENSe:DEModulation:AD:RAMP:TIME:DOWN:STARt command

User Interface:	802.11ad Demodulation Settings > Ramp time > Ramp Down Start Ratio
Command:	`:SENSe:DEModulation:AD:RAMP:TIME:DOWN:STARt <threshold>` `:SENSe:DEModulation:AD:RAMP:TIME:DOWN:STARt?`
Example:	`:SENS:DEM:AD:RAMP:TIME:DOWN:STAR .1`
Notes:	Enter the location of the Packet Falling Edge within the Ramp Time Length. The default value of 0.50 places the packet falling edge in the center of the Ramp Time Length. Values < 0.5 move the packet falling edge earlier in the ramp time length, values > 0.9 move the packet falling edge later in the ramp time length. The default value is 0.50. The range is 0.10 to 0.90.

:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:HIGH command

User Interface:	802.11ad Demodulation Settings > Ramp time > Ramp Down High Threshold
Command:	`:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:HIGH <threshold>` `:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:HIGH?`
Example:	`:SENS:DEM:AD:RAMP:TIME:DOWN:THR:HIGH .11`
Notes:	Set/get the start (high) threshold for the transmit power-down ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to fall from the upper to the lower threshold.) The default value is .9 (90%). The range is .01 to .99. The query returns the current setting.

:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:LOW

User Interface:	802.11ad Demodulation Settings > Ramp time > Ramp Down Low Threshold
Command:	`:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:LOW <threshold>` `:SENSe:DEModulation:AD:RAMP:TIME:DOWN:THReshold:LOW?`
Example:	`:SENS:DEM:AD:RAMP:TIME:DOWN:THR:LOW .11`
Notes:	Set/get the stop (low) threshold for the transmit power-down ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to fall from the upper to the lower threshold.) The default value is .1 (10%). The range is .01 to .99. The query returns the current setting.

:SENSe:DEModulation:AD:RAMP:TIME:LENGth command

User Interface:	802.11ad Demodulation Settings > Ramp time > Ramp Time Length
Command:	`:SENSe:DEModulation:AD:RAMP:TIME:LENGth <seconds>` `:SENSe:DEModulation:AD:RAMP:TIME:LENGth?`
Example:	`:SENS:DEM:AD:RAMP:TIME:LENG 15 ns`
Notes:	Enter the length for the search window to be used for the ramp up and down measurement. (Note: if the length is too small, the ramp may not be found.) The default value is 2.0E-08 (20 ns). The range is 5.0E-09 to 5.0E-08 (5 to 50 ns). Specify in ns to use whole numbers.

:SENSe:DEModulation:AD:RAMP:TIME[:STATe] command

User Interface:	802.11ad Demodulation Settings > Ramp time > Ramp Time On
Command:	`:SENSe:DEModulation:AD:RAMP:TIME[:STATe] OFF|ON|0|1` `:SENSe:DEModulation:AD:RAMP:TIME[:STATe]?`
Example:	`:SENS:DEM:AD:RAMP:TIME ON`
Notes:	Enable/disable transmit ramp up and ramp down time measurement. (To allow the measurement to be made using a modulated signal, this measurement filters the sampled data by taking the maximum sample in a moving window.) Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:HIGH command

User Interface:	802.11ad Demodulation Settings > Ramp time > Ramp Up Time High Threshold
Command:	`:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:HIGH <threshold>` `:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:HIGH?`
Example:	`:SENS:DEM:AD:RAMP:TIME:UP:THR:HIGH .89`
Notes:	Set/get the stop (high) threshold for the transmit power-up ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to rise from the lower to the upper threshold.) The default value is .9 (90%). The range is .01 to .99. The query returns the current setting.

:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:LOW command

User Interface:	802.11ad Demodulation Settings > Ramp time > Ramp Up Time Low Threshold
Command:	`:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:LOW <threshold>` `:SENSe:DEModulation:AD:RAMP:TIME:UP:THReshold:LOW?`
Example:	`:SENS:DEM:AD:RAMP:TIME:UP:THR:LOW .11`
Notes:	Set/get the start (low) threshold for the transmit power-up ramp, as a percentage of maximum power to be transmitted in the frame. (The transmit power-down ramp is defined as the time it takes the transmitter to rise from the lower to the upper threshold.) The default value is .1 (10%). The range is .01 to .99. The query returns the current setting.

:SENSe:DEModulation:AD:SCLock:MODE command

User Interface:	802.11ad Demodulation Settings > Symbol Clock Settings > Symbol Clock Compensation Mode
Command:	`:SENSe:DEModulation:AD:SCLock:MODE AUTO|MANual` `:SENSe:DEModulation:AD:SCLock:MODE?`
Example:	`:SENS:DEM:AD:SCL:MODE AUTO`
Notes:	Set or get the Symbol Clock Compensation Mode. If AUTO, the measured symbol clock offset estimate will be used. If MANual, the offset specified in the command odulation:AD:SCLock:VALue `:SENSe:DEModulation:AD:SCLock:VALue` will be used. MANual is the default setting.

:SENSe:DEModulation:AD:SCLock:VALue command

User Interface:	802.11ad Demodulation Settings > Symbol Clock Settings > Symbol Clock Offset
Command:	`:SENSe:DEModulation:AD:SCLock:VALue <offset>` `:SENSe:DEModulation:AD:SCLock:VALue?`
Example:	`:SENS:DEM:AD:SCL:VALue 15`
Notes:	This sets the symbol clock offset value in ppm, if the command `:SENSe:DEModulation:AD:SCLock:MODE` has been set to `MANual`. Default: 0. Range: -900000 to +100.

:SENSe:DEModulation:AD:SPATracking command

User Interface:	802.11ad Demodulation Settings > Tracking > SC PHY Amplitude Tracking
Command:	`:SENSe:DEModulation:AD:SPATracking OFF|ON|0|1` `:SENSe:DEModulation:AD:SPATracking?`
Example:	`:SENS:DEM:AD:SPAT ON`
Notes:	SC PHY Amplitude Tracking. If true, amplitude tracking is applied when demodulating SC PHY packets. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:DEModulation:AD:SPPTracking command

User Interface:	802.11ad Demodulation Settings > Tracking > SC PHY Phase Tracking
Command:	`:SENSe:DEModulation:AD:SPPTracking OFF|ON|0|1` `:SENSe:DEModulation:AD:SPPTracking?`
Example:	`:SENS:DEM:AD:SPPT ON`
Notes:	SC PHY Phase Tracking. If true, phase tracking is applied when demodulating SC PHY packets. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:DEModulation:AD[:STATe] command

User Interface:	802.11ad Demodulation Settings > Analysis Mode > Demod On
Command:	`:SENSe:DEModulation:AD[:STATe] OFF|ON|0|1` `:SENSe:DEModulation:AD[:STATe]?`
Example:	`:SENS:DEM:AD ON`
Notes:	Demod On. If true, the demod will run on the acquired data, if false it will not. Send 1 or ON to enable; send 0 or OFF to disable. Default: False. The query returns the current state.

:SENSe:DEModulation:AD:THReshold command

User Interface:	802.11ad Demodulation Settings > Packet Search > Search Threshold
Command:	`:SENSe:DEModulation:AD:THReshold <numeric_value>` `:SENSe:DEModulation:AD:THReshold?`
Example:	`:SENS:DEM:AD:THR 40` `:SENS:DEM:AD:THR?`
Notes:	Search Threshold. This sets/gets the search threshold (in dB) which is used if the Packet Search Mode was set to `FIRst` by the `:SENSe:DEModulation:AD:PSEarch` command. Default: 15. Range: 10 to 100.

:SENSe:FEED Commands

:SENSe:FEED:PORT:INFormation? query

User Interface:	(Command only)
Command:	`:SENSe:FEED:PORT:INFormation? A1|A2|A3|B1|B2|B3|IFIO1|IFIO2`
Example:	`:SENSe:FEED:INF? A1`
Notes:	Return the connection status (0 or 1) and SN (that is, the serial number of a connected M1650A mmWave Transceiver) for a named port. The connection status 1 indicates that the port is licensed for use in this instrument, and also (in the case of a mmWave Port) indicates that the port is connected to an M1650A mmWave Transceiver. A connection status of 0 indicates that the port is either not licensed for use or is not connected to an M1650A (the latter consideration doesn't apply to IFIO ports). The SN is the serial number of the connected M1650A; this is irrelevant to an IFIO port, so in that case an empty string is always returned. Example result (for a mm W port): `1, "US56160060"` Example result (for an IFIO port): `1, ""`

:SENSe:FEED:PORT[:INPut] command

User Interface:	System Configuration > Input/Output Port > Input Port
Command:	`:SENSe:FEED:PORT[:INPut] NONE|A1|A2|A3|B1|B2|B3|IFIO1|IFIO2` `:SENSe:FEED:PORT[:INPut]?`
Example:	`:SENSe:FEED:PORT A1`
Notes:	Get/set the receiver port. The query returns the current setting. The available selections for the Input Port are limited by other settings; see "Port Rules (mmWave Ports)" on page 138 and "Port Rules (IO Ports)" on page 140.

:SENSe:FEED:PORT:OUTPut command

User Interface:	System Configuration > Input/Output Port > Output Port
Command:	`:SENSe:FEED:PORT:OUTPut NONE|A1|A2|A3|B1|B2|B3|IFIO1|IFIO2` `:SENSe:FEED:PORT:OUTPut?`
Example:	`:SENS:FEED:PORT:OUTP B2`
Notes:	Get/set the transmitter port. The query returns the current setting. The available selections for the Output Port are limited by other settings; see "Port Rules (mmWave Ports)" on page 138 and "Port Rules (IO Ports)" on page 140.

:SENSe:FREQuency Commands

:SENSe:FREQuency:BANDwidth|BWIDth:SHAPe command

User Interface:	Acquisition Settings > Measure - Spectrum > Res BW Shape
Command:	`:SENSe:FREQuency:BANDwidth|BWIDth:SHAPe FLATtop|GAUSsian` `:SENSe:FREQuency:BANDwidth|BWIDth:SHAPe?`
Example:	`:SENS:FREQ:BAND:SHAPe GAUS`
Notes:	The filter type (FLATtop or GAUSsian) for resolution bandwidth (RBW). FLATtop is the default setting. The query returns the current setting.

:SENSe:FREQuency:BANDwidth|BWIDth:VALue command

User Interface:	Acquisition Settings > Measure - Spectrum > Res BW
Command:	`:SENSe:FREQuency:BANDwidth|BWIDth:VALue <frequency>` `:SENSe:FREQuency:BANDwidth|BWIDth:VALue?`
Example:	`:SENS:FREQ:BAND:VAL 2 MHz`
Notes:	Get/set the resolution bandwidth (RBW) in Hz. Default: 1 MHz. Range: 100 kHz to 10 MHz. (BWIDth is supported as an alternative spelling for the BANDwidth parameter.)

:SENSe:FREQuency:CENTer command

User Interface:	Acquisition Settings > Data Acquire > Center
Command:	`:SENSe:FREQuency:CENTer <freq>` `:SENSe:FREQuency:CENTer?`
Example:	`:SENS:FREQ:CENT 9000 MHz`
Notes:	Get/set the measurement center frequency in Hz or MHz. Default: 3.0E+09 Hz.

:SENSe:FREQuency:MIRRor command

User Interface:	Acquisition Settings > Data Acquire > Mirror Frequency
Command:	`:SENSe:FREQuency:MIRRor OFF|ON|0|1` `:SENSe:FREQuency:MIRRor?`
Example:	`:SENS:FREQ:MIRR ON` `:SENS:FREQ:MIRR?`
Notes:	Enable or disable the Mirror Frequency mode, which is used to obtain a correct display of a "flipped" spectrum. When the measured signal is mixed down from a higher frequency and its spectrum is flipped (mirrored around the center frequency) owing to the mixing scheme used, enabling Mirror Frequency mode reverses the marker readings and frequency annotation with respect to the signal as actually received by the test set hardware. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SENSe:FREQuency:SPAN command

User Interface:	Acquisition Settings > Measure - Spectrum > Span
Command:	`:SENSe:FREQuency:SPAN <frequency>` `:SENSe:FREQuency:SPAN?`
Example:	`:SENS:FREQ:SPAN 1 GHz` `:SENS:FREQ:SPAN?`
Notes:	Get/set the measurement frequency span in Hz. Default: 1.85 GHz. Range: 10 MHz to 2.112 GHz. The query returns the current state.

:SENSe PSTatistic Commands

:SENSe:PSTatistic[:STATe] command

User Interface:	Acquisition Settings > Measure - Power Stat (CCDF) > Power Stat On
Command:	`:SENSe:PSTatistic[:STATe] OFF|ON|0|1` `:SENSe:PSTatistic[:STATe]?`
Example:	`:SENS:PST ON` `:SENS:PST?`
Notes:	Enable/disable the Power Stat (CCDF) measurement. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state. The measurement is disabled by default.

:SENSe:PSTatistic:CDEMod command

User Interface:	Acquisition Settings > Measure - Power Stat (CCDF) > Couple to Demod
Command:	`:SENSe:PSTatistic:CDEMod OFF|ON|0|1` `:SENSe:PSTatistic:CDEMod?`
Example:	`:SENS:PST:CDEM ON` `:SENS:PST:CDEM?`
Notes:	Enable/disable coupling of the Power Stat (CCDF) measurement to the demodulation measurement. If the measurements are coupled, the Power Stat measurement will use the packet's start time and packet length (which are calculated by demodulation) to calculate the power statistics (in this case, if demodulation measurement is not turned on, NAN values will be returned). If the measurements are not coupled, the Power Stat measurement will use its own start time and measurement interval to calculate the power statistics. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state. Coupling id disabled by default.

:SENSe:PSTatistic:TIME:INTerval command

User Interface:	Acquisition Settings > Measure - Power Stat (CCDF) > Meas Interval
Command:	`:SENSe:PSTatistic:TIME:INTerval <time>` `:SENSe:PSTatistic:TIME:INTerval?`
Example:	`:SENS:PST:TIME:INT 2 us` `:SENS:PST:TIME:INT?`
Notes:	Set/get the measurement interval of the Power Stat (CCDF) measurement, in seconds. The query returns the current setting. Range: 0 or greater. Default: 2 µs. The value can also be given in MIN or HR. This setting is relevant only if the Power Stat measurement is not coupled to the demodulation measurement (see the `:SENSe:PSTatistic:CDEMod` command above).

:SENSe:PSTatistic:TIME:STARt command

User Interface:	Acquisition Settings > Measure - Power Stat (CCDF) > Meas Time Offset
Command:	`:SENSe:PSTatistic:TIME:STARt <time>` `:SENSe:PSTatistic:TIME:STARt?`
Example:	`:SENS:PST:TIME:STAR 0.01 s` `:SENS:PST:TIME:STAR?`
Notes:	Set/get the time offset, relative to the start boundary, of the Power Stat (CCDF) measurement, in seconds. The query returns the current setting. Range: 0 or greater. Default: 0. The value can also be given in MIN or HR. This setting is relevant only if the Power Stat measurement is not coupled to the demodulation measurement (see the `:SENSe:PSTatistic:CDEMod` command above). The default setting is 0 seconds.

:SENSe:ROSCillator Commands

:SENSe:ROSCillator:EXTernal:FREQuency command

User Interface:	System Configuration > Freq Ref In > Ext Ref Freq
Command:	`:SENSe:ROSCillator:EXTernal:FREQuency <numerical_value>` `:SENSe:ROSCillator:EXTernal:FREQuency?`
Example:	`:SENS:ROSC:EXT:FREQ 20 MHz`
Notes:	Specifies the frequency of the external reference. When the external reference is in use (see the `:SENS:ROSC:SOUR:TYPE` command), this information is used by the instrument to make 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 input frequency. Permissible values for this are 10, 20, 30, 40, or 50 MHz.

:SENSe:ROSCillator:SOURce:TYPE command

User Interface:	System Configuration > Freq Ref In > Reference Source
Command:	`:SENSe:ROSCillator:SOURce:TYPE INTernal|EXTernal` `:SENSe:ROSCillator:SOURce:TYPE?`
Example:	`:SENS:ROSC:SOUR:TYPE EXT`
Notes:	Specifies the frequency reference as being the internal reference or an external input received at the connector labeled 10 MHz IN on the rear panel. When the frequency reference is set to Internal, the internal 10 MHz reference is used even if an external reference is connected at the rear panel.

:SENSe:SEMask Commands

:SENSe:SEMask:EXTend:FREQuency command

User Interface:	Transmit Mask Settings > Meas Mode > Extend Freq
Command:	`:SENSe:SEMask:EXTend:FREQuency <Hz>` `:SENSe:SEMask:EXTend:FREQuency?`
Example:	`:SENS:SEM:EXT:FREQ 312 MHz`
Notes:	Enter a value in Hz to extend the frequency for Offset D (see below) beyond the +/- 3.06 GHz range. The default setting is 0 Hz. The range is 0 to 629 MHz. Specify 'MHz' to use whole numbers. Note that the Minimum Start Frequency or Maximum Stop Frequency of the selected Input Port may limit the range.

:SENSe:SEMask:BANDwidth[:RESolution] command

User Interface:	Transmit Mask Settings > Band wid th Settings > ResBw
Command:	`:SENSe:SEMask:BANDwidth[:RESolution] <bandwidth>` `:SENSe:SEMask:BANDwidth[:RESolution]?`
Example:	`:SENS:SEM:BAND 2 MHz`
Notes:	Set/get the resolution bandwidth used to calculate the power in the reference channel, in Hz. Default: 1 MHz. Range: 100 kHz to 10 MHz. The query returns the current setting.

:SENSe:SEMask:MODE command

User Interface:	Transmit Mask Settings > Meas Mode > Mode
Command:	`:SENSe:SEMask:MODE NORM|RANG` `:SENSe:SEMask:MODE?`
Example:	`:SENS:SEM:MODE RANG`
Notes:	Set/get the measurement mode (Normal or High Dynamic Range) for transmit mask (SEM). The query returns the current setting. Normal is the default setting. Note that High Dynamic Range mode may not be compatible with the 802.11ad standard.

:SENSe:SEMask:MODE:RANGe:BANDwidth[:RESolution] command

User Interface:	Transmit Mask Settings > Band wid th Settings > ResBw
Command:	`:SENSe:SEMask:MODE:RANGe:BANDwidth[:RESolution] <bandwidth>` `:SENSe:SEMask:MODE:RANGe:BANDwidth[:RESolution]?`
Example:	`:SENS:SEM:MODE RANG 1 MHz`
Notes:	Set/get the resolution bandwidth (in Hz) to be used when the High Dynamic Range mode is selected (see the `:SENSe:SEMask:MODE` command above). The query returns the current setting. 100 kHz is the default setting. The range is 10 kHz to 10 MHz. Note that settings other than 1 MHz may not be compatible with the 802.11ad standard.

:SENSe:SEMask:OFFSet:LIST:FREQuency command

User Interface:	Transmit Mask Settings > Offset *n* > Start Freq
Command:	`:SENSe:SEMask:OFFSet:LIST:FREQuency <frequencies>` `:SENSe:SEMask:OFFSet:LIST:FREQuency?`
Example:	`:SENS:SEM:OFFS:LIST:FREQ 940MHz, 1.2GHz, 2.7GHz, 3.06GHz`
Notes:	Set/get the frequency offsets for transmit mask (SEM), as a comma-separated list, in Hz. The query returns the current setting.

:SENSe:SEMask:OFFSet:LIST:LIMit command

User Interface:	Transmit Mask Settings > Offset *n* > Limit
Command:	`:SENSe:SEMask:OFFSet:LIST:LIMit <limits>` `:SENSe:SEMask:OFFSet:LIST:LIMit?`
Example:	`:SENS:SEM:OFFS:LIST:LIM 0, -17, -22, -30`
Notes:	Get/set the limits of relative peak spectral density (in dBr) for transmit mask (SEM), as a comma-separated list. The query returns the current setting.

:SENSe:SEMask[:STATe] command

User Interface:	Transmit Mask Settings > Analysis Mode > Transmit Mask On
Command:	`:SENSe:SEMask[:STATe} OFF|ON|0|1` `:SENSe:SEMask[:STATe]?`
Example:	`:SENS:SEM ON`
Notes:	Enable/disable transmit mask (SEM) measurement. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state. The measurement is disabled by default.

:SENSe:SWEep Commnds

:SENSe:SWEep:POINts command

User Interface:	(Command only)
Command:	`:SENSe:SWEep:POINts <numeric value>` `:SENSe:SWEep:POINts?`
Example:	`:SENS:SWE:POIN 200`
Notes:	Specify the number of measurements to be taken (see "Point Sweep Measurement" on page 79). The default value is 10. The range is 1 - 1000.

:SENSe:SWEep[:STATe] command

User Interface:	(Command only)
Command:	`:SENSe:SWEep[:STATe] 0|1` `:SENSe:SWEep[:STATe]?`
Example:	`:SENS:SWE 1`
Notes:	Enable or disable Point Sweep Mode (see "Point Sweep Measurement" on page 79). Use 0 for False, 1 for True.

:SENSe:TDPower Commands

:SENSe:TDPower[:STATe] command

User Interface:	Acquisition Settings > Measure - Time Domain Power > Time Domain Power On
Command:	`:SENSe:TDPower[:STATe] OFF|ON|0|1` `:SENSe:TDPower[:STATe]?`
Example:	`:SENS:TDP ON`
Notes:	Enable/disable time domain power measurement. Send 1 or ON to enable; send 0 or OFF to disable. The measurement is disabled by default. The query returns the current state.

:SENSe:TDPower:TIME:INTerval command

User Interface:	Acquisition Settings > Measure - Time Domain Power > Power Time Interval
Command:	`:SENSe:TDPower:TIME:INTerval <time>` `:SENSe:TDPower:TIME:INTerval?`
Example:	`:SENS:TDP:TIME:INT`
Notes:	Set/get the time interval of time domain power measurement in seconds. Range: 0 or greater. Default: 2.0E-6. Value can also be given in MIN or HR.

:SENSe:TDPower:TIME:REFerence command

User Interface:	(Acquisition Settings > Measure - Time Domain Power > Power Start Reference
Command:	`:SENSe:TDPower:TIME:REFerence ACQuire|PACKet` `:SENSe:TDPower:TIME:REFerence?`
Example:	`:SENS:TDP:TIME:REF PACK`
Notes:	Set/get the reference start boundary of time domain power measurement. The choices are ACQuire (the start point of the acquisition is the reference boundary) or PACKet (the start point of the packet is the reference boundary). For most general-purpose uses, ACQuire is the recommended setting; it is selected by default. The query returns the current state.

:SENSe:TDPower:TIME:STARt command

User Interface:	Acquisition Settings > Measure - Time Domain Power > Power Time Offset
Command:	`:SENSe:TDPower:TIME:STARt <time>` `:SENSe:TDPower:TIME:STARt?`
Example:	`:SENS:TDP:TIME:STAR 2.0E-3`
Notes:	Set/get the time offset, relative to the start boundary, of time domain power measurement in seconds. Range: 0 or greater. Default: 0. Value can also be given in MIN or HR.

:SENSe:TIME Commands

:SENSe:TIME:LENGth command

User Interface:	Acquisition Settings > Data Acquire > Main Length
Command:	`:SENSe:TIME:LENGth <length>` `:SENSe:TIME:LENGth?`
Example:	`:SENS:TIME:LENG 2E-05`
Notes:	Get/set the main time length in seconds. Range: 1.5152E-08 to 1.0E-03. Default: 2E-05.

:SENSe:TIME:SRATe? query

User Interface:	Final Waveform Settings > Sample Rate> Sample Rate
Command:	`:SENSe:TIME:SRATe?`
Example:	`:SENS:TIME:SRAT?`
Notes:	Return the sample rate of captured data in Hz.

:SOURce:RADio:AD Commands

[:SOURce]:RADio:AD[1]|2|3...8:AGGRegation command

User Interface:	802.11ad Segment > Waveform Structure > Interpacket Gap
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:AGGRegation OFF|ON|0|1` `[:SOURce]:RADio:AD[1]|2|3...8:AGGRegation?`
Example:	`:RAD:AD2:AGGR ON`
Notes:	Set/Clear the Aggregation bit. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

[:SOURce]:RADio:AD[1]|2|3...8:ALPHa command

User Interface:	802.11ad Segment > Modulation > Shaping Filter BT/Shape
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:ALPHa <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:ALPHa?`
Example:	`:RAD:AD3:ALPH 0.29`
Notes:	This sets the BT product for Gaussian filtering and the shape factor for RC/RRC filtering.Range: .001 to .99. The value may be incremented or decremented by sending **UP** or **DOWN** as a parameter to the command.

[:SOURce]:RADio:AD[1]|2|3...8:BTRacking command

User Interface:	802.11ad Segment > Header > Beam Tracking
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:BTRacking OFF|ON|0|1` `[:SOURce]:RADio:AD[1]|2|3...8:BTRacking?`
Example:	`:RAD:AD4...8:BTR ON`
Notes:	Set/Clear the Beam Tracking Request bit. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

[:SOURce]:RADio:AD[1]|2|3...8:COFFset command

User Interface:	802.11ad Segment > Payload > Symbol Clock Offset
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:COFFset <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:COFFset?`
Example:	`:RAD:AD5:COFF 10`
Notes:	the symbol clock offset in ppm. Range: -900000 to 100. The value may be incremented or decremented by sending **UP** or **DOWN** as a parameter to the command.

[:SOURce]:RADio:AD[1]|2|3...8:CONTent:FCSequence command

User Interface:	802.11ad Segment > Payload > FCS On
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:CONTent:FCSequence OFF|ON|0|1` `[:SOURce]:RADio:AD[1]|2|3...8:CONTent:FCSequence?`
Example:	`:RAD:AD6:CONT:FCS ON`
Notes:	Enable/disable FCS. If the FCS On is set to 'true', there is a 32-bit FCS (Frame Check Sequence) at the end of the payload content. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

[:SOURce]:RADio:AD[1]|2|3...8:CONTent:FILE command

User Interface:	802.11ad Segment > Payload > Payload Content File
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:CONTent:FILE <filename>` `[:SOURce]:RADio:AD[1]|2|3...8:CONTent:FILE?`
Example:	`:RAD:AD7:CONT:FILE "C:\Temp\File1.txt"`
Notes:	Payload Content File. If the Content is set to 'From File' the data in this file will be used as the payload. The file should be a text file containing 1's and 0's, any other characters such as spaces or carriage returns will be ignored. If the end of file is reached, reading will start at the beginning again (e.g. if the payload is longer than the amount of data in the file)

[:SOURce]:RADio:AD[1]|2|3...8:CONTent[:TYPE] command

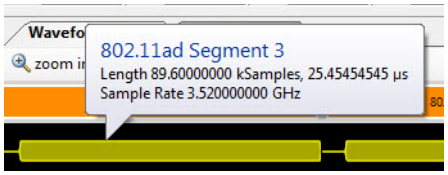
User Interface:	802.11ad Segment > Payload > Payload Content

Command:	`[:SOURce]:RADio:AD[1]|2|3...8:CONTent[:TYPE]`
	`PN23|ALL1|ALL0|COUNt|COUNT32|FILE`
	`[:SOURce]:RADio:AD[1]|2|3...8:CONTent[:TYPE]?`

Example:	`:RAD:AD8:CONT FILE`
Notes:	Payload Content. Determines the PSDU data content.

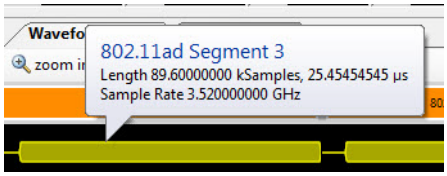
[:SOURce]:RADio:AD[1]|2|3...8:DATA:LENGth? query

User Interface:	(Information displayed when cursor hovers over a waveform segment)
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:DATA:LENGth?`
Example:	`:RAD:AD3:DATA:LENG?`
Notes:	Used to query the length of the segment in µs which would be displayed by hovering over the specified 802.11ad Segment on the display.



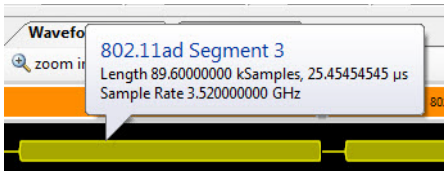
[:SOURce]:RADio:AD[1]|2|3...8:DATA:NSAMples? query

User Interface:	(Information displayed when cursor hovers over a waveform segment)
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:DATA:NSAMples?`
Example:	`:RAD:AD3:DATA:NSAM?`
Notes:	Used to query the length of the segment in kSamples which would be displayed by hovering over the specified 802.11ad Segment on the display.



[:SOURce]:RADio:AD[1]|2|3...8:DATA:SRATe? query

User Interface:	(Information displayed when cursor hovers over a waveform segment)
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:DATA:SRATe?`
Example:	`:RAD:AD3:DATA:SRAT?`
Notes:	Used to query the Sample Rate value which would be displayed by hovering over the specified 802.11ad Segment on the display.



[:SOURce]:RADio:AD[1]|2|3...8:GAP command

User Interface:	802.11ad Segment > Waveform Structure >Interpacket Gap
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:GAP <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:GAP?`
Example:	`:RAD:AD6:GAP .0001` `:RAD:AD6:GAP?`
Notes:	The Inter-packet gap value determines the duration in seconds of the zero signal energy period preceding each packet. The value is limited to 0 to 200 µs. The default value is 2µs. The query is used to find the minimum and maximum values of the parameter.

[:SOURce]:RADio:AD[1]|2|3...8:LENgth:CPHY command

User Interface:	802.11ad Segment > Header > Length (octets)
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:LENgth:CPHY <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:LENgth:CPHY? [MINimum|MAXimum]`
Example:	`:RAD:AD7:LEN:CPHY 20` `:RAD:AD7:LEN:CPHY? MIN`
Notes:	Set the Control PHY PSDU length in octets. For Control PHY mode (MCS0 -- set by the `RADio:AD:MCS` command) this is limited to the range 14 - 1023. The query is used to find the minimum and maximum values of the parameter.

[:SOURce]:RADio:AD[1]|2|3...8:LENgth:NCPHy command

User Interface:	802.11ad Segment > Header > Length (octets)
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:LENgth:NCPHy <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:LENgth:NCPHy? [MINimum|MAXimum]`
Example:	`:RAD:AD8:LEN:NCPH 40` `:RAD:AD8:LEN:NCPH MIN`
Notes:	Set the non-Control PHY PSDU length in octets. For non-Control PHY modes (MCS1 through MCS12 -- set by the `RADio:AD:MCS` command), this is limited to the range 0 - 262143. The query is used to find the minimum and maximum values of the parameter.

[:SOURce]:RADio:AD[1]|2|3...8:LRSS command

User Interface:	802.11ad Segment > Header > Last RSSI
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:LRSS <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:LRSS? [MINimum|MAXimum]?`
Example:	`:RAD:AD2:LRSS`
Notes:	Sets the Last RSSI field. Range: 0 to15. The query is used to find the minimum and maximum values of the parameter.

[:SOURce]:RADio:AD[1]|2|3...8:MCS command

User Interface:	802.11ad Segment > Header > Modulation and Coding Scheme (MCS)
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:MCS <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:MCS? [MINimum|MAXimum]`
Example:	`:RAD:AD3:MCS 14` `:RAD:AD3:MCS? MIN`
Notes:	This command allows you to set and get the MCS number of the selected segment. Note that the range of valid MCS numbers varies with different version of the spec document. Range: 0 to 31. The query is used to find the minimum and maximum values of the parameter.

[:SOURce]:RADio:AD[1]|2|3...8:NPACkets command

User Interface:	802.11ad Segment > Waveform Structure > Packets in Waveform
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:NPACkets <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:NPACkets? [MINimum|MAXimum]`
Example:	`:RAD:AD4:NPAC 42` `:RAD:AD4:NPAC? MIN`
Notes:	This controls how many different packets are generated in the segment. If the segment is specified to contain more than one packet and the payload is specified as PN data, then the PN sequence runs on through all packets in the segment. The advantage of specifying more than one packet in the segment (assuming a pseudo-random payload) is that the RF spectrum will be more random.The disadvantage is that the resulting output file will take longer to generate and will be larger. Range: 1 to 80. The query is used to find the minimum and maximum values of the parameter.

[:SOURce]:RADio:AD[1]|2|3...8:PPDU command

User Interface:	802.11ad Segment > Header > Additional PPDU
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:PPDU OFF|ON|0|1` `[:SOURce]:RADio:AD[1]|2|3...8:PPDU?`
Example:	`:RAD:AD5:PPDU ON`
Notes:	Additional PPDU. Set/Clear the Additional PPDU bit. To generate a Additional PPDU packets, add a second segment that has Preamble off, and no Interpacket Gap. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

[:SOURce]:RADio:AD[1]|2|3...8:PREamble command

User Interface:	802.11ad Segment > Waveform Structure > Preamble On
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:PREamble OFF|ON|0|1` `[:SOURce]:RADio:AD[1]|2|3...8:PREamble?`
Example:	`:RAD:AD6:PRE ON`
Notes:	Preamble On. When true, the preamble is generated. When false, no preamble is generated. This can be used in conjunction with the APPDU and Interpacket Gap settings to generate Additional PPDU packets. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

[:SOURce]:RADio:AD[1]|2|3...8:PTYPE command

User Interface:	802.11ad Segment > Header > Packet Type
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:PTYPE TRNR|TRNT` `[:SOURce]:RADio:AD[1]|2|3...8:PTYPE?`
Example:	`:RAD:AD7:PTYP TRNR`
Notes:	Select the training packet type.

[:SOURce]:RADio:AD[1]|2|3...8:SHAPing command

User Interface:	802.11ad Segment > Header > SC Shaping Filter
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:SHAPing NONE|GAUSsian|RCOSine|RRCosine` `[:SOURce]:RADio:AD[1]|2|3...8:SHAPing?`
Example:	`:RAD:AD8:SHAP RCOS`
Notes:	Select the spectrum shaping applied to all Single Carrier (SC) and Low Power Single Carrier (LPSC) modulated packets. MCS0-12, 25-27.

[:SOURce]:RADio:AD[1]|2|3...8:SIFS command

User Interface:	802.11ad Segment > Header > Turnaround
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:SIFS OFF|ON|0|1` `[:SOURce]:RADio:AD[1]|2|3...8:SIFS?`
Example:	`:RAD:AD2:SIFS ON`
Notes:	Set/Clear the Turnaround (SIFS Response) bit. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

[:SOURce]:RADio:AD[1]|2|3...8:SINit:CPHY command

User Interface:	802.11ad Segment > Header > Scrambler Initialization
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:SINit:CPHY <nondecimal_numeric>` `[:SOURce]:RADio:AD[1]|2|3...8:SINit:CPHY?`
Example:	`:RAD:AD3:SIN:CPHY 2F`
Notes:	Set the scrambler initialization pattern for Control PHY Segments (MCS0). In MCS0, the least significant 4 bits are used to seed the scrambler.

[:SOURce]:RADio:AD[1]|2|3...8:SINit:NCPHy command

User Interface:	802.11ad Segment > Header > Scrambler Initialization
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:SINit:NCPHy <nondecimal_numeric>` `[:SOURce]:RADio:AD[1]|2|3...8:SINit:NCPHy?`
Example:	`:RAD:AD4:SIN:NCPH 4D`
Notes:	Set the scrambler initialization pattern for non-Control PHY segments (MCS1-MCS12). In non-Control PHY modes the least significant 7 bits are used. [Does nondecimal mean hex, or what]

[:SOURce]:RADio:AD[1]|2|3...8:TLENgth command

User Interface:	802.11ad Segment > Header >Training Length
Command:	`[:SOURce]:RADio:AD[1]|2|3...8:TLENgth <numeric_value>` `[:SOURce]:RADio:AD[1]|2|3...8:TLENgth? [MINimum|MAXimum]`
Example:	`:RAD:AD5:TLEN 21` `:RAD:AD5:TLEN? MIN`
Notes:	Set the length of the training field. Range: 0 to 31. The query is used to find the minimum and maximum values of the parameter.

[:SOURce]:RADio:MARKer Command

User Interface:	Final Waveform Settings > Marker Settings > Marker *n* Type
Command:	`[:SOURce]:RADio:MARKer[1]|2|3|4:TYPE NONE\WSTart\RFBLanking` `[:SOURce]:RADio:MARKer[1]|2|3|4:TYPE?`
Example:	`:RAD:MARK2:TYPE WST`
Notes:	Determines what type of source is used for the marker.

:SOURce:TRACk Commands

[:SOURce]:TRACk:IFCHannel command

User Interface:	(Command only)
Command:	`[:SOURce]:TRACk:IFCHannel CH1|CH2` `[:SOURce]:TRACk:IFCHannel?`
Example:	`:TRAC:IFCH CH1`
Notes:	Track IF Channel. This determine which channel the upconverted signal is placed on. Channel 1 refers to the channel that would otherwise hold the I data, and Channel 2 refers to the channel that would otherwise hold the Q data of a baseband (non up-converted) signal. This only applies if the Offset Frequency for the track is non-zero.

[:SOURce]:TRACk:IFRequency command

User Interface:	Final Waveform Settings > Track Settings > Track Offset Frequency
Command:	`[:SOURce]:TRACk:IFRequency <numeric_value>` `[:SOURce]:TRACk:IFRequency?`
Example:	`:TRAC:IFR 100 MHz`
Notes:	Track Offset Frequency. This sets the Offset Frequency for the track. A zero value means no upconversion; for values greater than zero, the track will be upconverted to the specified IF. Please note that for a given sample rate, the maximum valid offset will be equal to (Sample rate / 2.56) – (0.5 * Signal BW). 0 is the default setting. The range is -100000 MHz to +100000 MHz.

[:SOURce]:TRACk:PHASe command

User Interface:	Final Waveform Settings > Track Settings > Track Phase
Command:	`[:SOURce]:TRACk:PHASe <numeric_value>` `[:SOURce]:TRACk:PHASe?`
Example:	`:TRAC:PHAS 100 MHz`
Notes:	Set the phase factor for the track, in degrees. (A phase of 180 degrees essentially means this waveform will be subtracted). 0.00 is the default setting. The range is -360 to +360.

[:SOURce]:TRACk:SLISt:ADD command

User Interface:	(Command only)
Command:	[:SOURce]:TRACk:SLISt:ADD <unquoted_string>, <segment>
Example:	`:TRAC:SLIS:ADD MTONE, 2`
Notes:	This command will add a segment to the specified track. The unquoted string specifies the segment type that will be added: WIGIG, AD, MTONE, UTIL, HRP, LRPO, LRPD or LRPB. (The available choices depend on what licenses you have installed.) The numeric value specifies the Segment ID of the segment that will be added (range: 1 to 8).

[:SOURce]:TRACk:SLISt:CLEar command

User Interface:	(Command only)
Command:	`[:SOURce]:TRACk:SLISt:CLEar`
Example:	`:TRAC:SLIS:CLE`
Notes:	Clear all the segments in the track.

[:SOURce]:TRACk:SLISt:ID? query

User Interface:	(Command only)
Command:	`[:SOURce]:TRACk:SLISt:ID?`
Example:	`:TRAC:SLIS:ID?`
Notes:	This query returns the Segment IDs in the track, as a comma-separated list of ASCII values.

[:SOURce]:TRACk:SLISt:PREView:AUTO command

User Interface:	(Command only)
Command:	`[:SOURce]:TRACk:SLISt:PREView:AUTO OFF|ON|0|1` `[:SOURce]:TRACk:SLISt:PREView:AUTO?`
Example:	`:TRAC:SLIS:PREV:AUTO OFF`
Notes:	Enable or disable Auto mode for the segment list preview. If Auto mode is enabled, the waveform is automatically updated as soon as Final Waveform Settings are changed. If Auto mode is disabled, the waveform is not updated until the user initiates a Generate and Output. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state. Auto mode is enabled by default.

[:SOURce]:TRACk:SLISt:TYPE? query

User Interface:	(Command only)
Command:	`[:SOURce]:TRACk:SLISt:TYPE?`
Example:	`:TRAC:SLIS:TYPE?`
Notes:	This query returns the segment types in the track, as a comma-separated list of ASCII values.

:STATus:OPERation Commands

:STATus:OPERation:CONDition? query

User Interface:	(Command only)
Command:	`:STATus:OPERation:CONDition?`
Example:	`:STAT:OPER:COND?`
Notes:	This query returns the decimal value of the sum of the bits in the Status Operation Condition register.

:STATus:OPERation:ENABle command

User Interface:	(Command only)
Command:	`:STATus:OPERation:ENABle <numeric_value>` `:STATus:OPERation:ENABle?`
Example:	`:STAT:OPER:ENAB 1`
Notes:	This command determines which bits in the Operation Event register, will set the Operation Status Summary bit (bit 7) in the Status Byte Register. The numeric value is the sum of the decimal values of the bits you want to enable. The preset condition is to have all bits in this enable register set to 0. To have any Operation Events reported to the Status Byte Register, one or more bits need to be set to 1. Range: 0 to 65535.

:STATus:OPERation[:EVENt]? query

User Interface:	(Command only)
Command:	`:STATus:OPERation[:EVENt]?`
Example:	`:STAT:OPER?`
Notes:	This query returns the decimal value of the sum of the bits in the Operation Event register. The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared. Range: 0 to 32767. ?

:STATus:OPERation:NTRansition command

User Interface:	(Command only)
Command:	`:STATus:OPERation:NTRansition <numeric_value>` `:STATus:OPERation:NTRansition?`
Example:	`:STAT:OPER:NTR 1`
Notes:	This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a negative transition (1 to 0). The numeric value is the sum of the decimal values of the bits that you want to enable. Range: 0 to 32767.

:STATus:OPERation:PTRansition command

User Interface:	(Command only)
Command:	`:STATus:OPERation:PTRansition <numeric_value>` `:STATus:OPERation:PTRansition?`
Example:	`:STAT:OPER:PTR 1`
Notes:	This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a positive transition (0 to 1). The numeric value is the sum of the decimal values of the bits that you want to enable. Range: 0 to 32767.

:STATus:QUEStionable Commands

:STATus:QUEStionable:CALibration:CONDition? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:CALibration:CONDition?`
Example:	`:STAT:QUES:CAL:COND?`
Notes:	This query returns the decimal value of the sum of the bits in the Questionable Calibration Condition register.

:STATus:QUEStionable:CALibration:ENABle command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:CALibration:ENABle <numeric_value>` `:STATus:QUEStionable:CALibration:ENABle?`
Example:	`:STAT:QUES:CAL:ENAB 16384`
Notes:	This command determines which bits in the Questionable Calibration Condition Register will set bits in the Questionable Calibration Event register, which also sets the Calibration Summary bit (bit 8) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable. STAT:QUES:CAL:ENAB 16384 Can be used to query if an alignment is needed, if you have turned off the automatic alignment process.

:STATus:QUEStionable:CALibration[:EVENt]? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:CALibration[:EVENt]?`
Example:	`:STAT:QUES:CAL?`
Notes:	This query returns the decimal value of the sum of the bits in the Questionable Calibration Event register. The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

:STATus:QUEStionable:CALibration:NTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:CALibration:NTRansition <numeric_value>` `:STATus:QUEStionable:CALibration:NTRansition?`
Example:	`:STAT:QUES:CAL:NTR 16384`
Notes:	Questionable Calibration Negative Transition. This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable. STAT:QUES:CAL:NTR 16384 Alignment is not required.

:STATus:QUEStionable:CALibration:PTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:CALibration:PTRansition <numeric_value>` `:STATus:QUEStionable:CALibration:PTRansition?`
Example:	`:STAT:QUES:CAL:PTR 16384`
Notes:	Questionable Calibration Positive Transition This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable. STAT:QUES:CAL:PTR 16384 Alignment is required.

:STATus:QUEStionable:CONDition? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:CONDition?`
Example:	`:STAT:QUES:COND?`
Notes:	Questionable Condition. This query returns the decimal value of the sum of the bits in the Questionable Condition register.

:STATus:QUEStionable:ENABle command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:ENABle <numeric_value>` `:STATus:QUEStionable:ENABle?`
Example:	`:STAT:QUES:ENAB 1`
Notes:	This command determines which bits in the Questionable Event register will set the Questionable Status Summary bit (bit3) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable. The preset condition is all bits in this enable register set to 0. To have any Questionable Events reported to the Status Byte Register, one or more bits need to be set to 1. The Status Byte Event Register should be queried after each measurement to check the Questionable Status Summary (bit 3). If it is equal to 1, a condition during the test may have made the test results invalid. If it is equal to 0, this indicates that no hardware problem or measurement problem was detected by the analyzer.

:STATus:QUEStionable[:EVENt]? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable[:EVENt]?`
Example:	`:STAT:QUES?`
Notes:	This query returns the decimal value of the sum of the bits in the Questionable Event register. The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

:STATus:QUEStionable:FREQuency:CONDition? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:FREQuency:CONDition?`
Example:	`:STAT:QUES:FREQ:COND?`
Notes:	This query returns the decimal value of the sum of the bits in the Questionable Frequency Condition register. The data in this register is continuously updated and reflects the current conditions.

:STATus:QUEStionable:FREQuency:ENABle command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:FREQuency:ENABle <numeric_value>` `:STATus:QUEStionable:FREQuency:ENABle?`
Example:	`:STAT:QUES:FREQ:ENAB 2`
Notes:	Questionable Frequency Enable This command determines which bits in the Questionable Frequency Condition Register will set bits in the Questionable Frequency Event register, which also sets the Frequency Summary bit (bit 5) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable. STAT:QUES:FREQ:ENAB 2 Frequency Reference Unlocked will be reported to the Frequency Summary of the Status Questionable register.

:STATus:QUEStionable:FREQuency[:EVENt]? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:FREQuency[:EVENt]?`
Example:	`:STAT:QUES:FREQ?`
Notes:	This query returns the decimal value of the sum of the bits in the Questionable Frequency Event register. The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

:STATus:QUEStionable:FREQuency:NTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:FREQuency:NTRansition <numeric_value>` `:STATus:QUEStionable:FREQuency:NTRansition?`
Example:	`:STAT:QUES:FREQ:NTR 2`
Notes:	Questionable Frequency Negative Transition This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable. STAT:QUES:FREQ:NTR 2 Frequency Reference 'regained lock' will be reported to the Frequency Summary of the Status Questionable register.

:STATus:QUEStionable:FREQuency:PTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:FREQuency:PTRansition <numeric_value>` `:STATus:QUEStionable:FREQuency:PTRansition?`
Example:	`:STAT:QUES:FREQ:PTR 2`
Notes:	Questionable Frequency Positive Transition This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable. STAT:QUES:FREQ:PTR 2 Frequency Reference 'became unlocked' will be reported to the Frequency Summary of the Status Questionable register.

:STATus:QUEStionable:INTegrity:CONDition? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:INTegrity:CONDition?`
Example:	`:STAT:QUES:INT:COND?`
Notes:	Questionable Integrity Condition This query returns the decimal value of the sum of the bits in the Questionable Integrity Condition register. The data in this register is continuously updated and reflects the current conditions.

:STATus:QUEStionable:INTegrity:ENABle command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:INTegrity:ENABle <numeric_value>` `:STATus:QUEStionable:INTegrity:ENABle?`
Example:	`:STAT:QUES:INT:ENAB 8`
Notes:	Questionable Integrity Enable This command determines which bits in the Questionable Integrity Condition Register will set bits in the Questionable Integrity Event register, which also sets the Integrity Summary bit (bit 9) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable. STAT:QUES:INT:ENAB 8 Measurement Uncalibrated Summary will be reported to the Integrity Summary of the Status Questionable register.

:STATus:QUEStionable:INTegrity[:EVENt]? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:INTegrity[:EVENt]?`
Example:	`:STAT:QUES:INT?`
Notes:	Questionable Integrity Event Query This query returns the decimal value of the sum of the bits in the Questionable Integrity Event register. The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

:STATus:QUEStionable:INTegrity:NTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:INTegrity:NTRansition <numeric_value>` `:STATus:QUEStionable:INTegrity:NTRansition?`
Example:	`:STAT:QUES:INT:NTR 8`
Notes:	Questionable Integrity Negative Transition This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a negative transition (1 to 0) The variable <integer> is the sum of the decimal values of the bits that you want to enable.STAT:QUES:INT:NTR 8 Measurement 'regained calibration' Summary will be reported to the Integrity Summary of the Status Questionable register.

:STATus:QUEStionable:INTegrity:PTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:INTegrity:PTRansition <numeric_value>` `:STATus:QUEStionable:INTegrity:PTRansition?`
Example:	`:STAT:QUES:INT:PTR 8`
Notes:	Questionable Integrity Positive Transition This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.STAT:QUES:INT:PTR 8 Measurement 'became uncalibrated' Summary will be reported to the Integrity Summary of the Status Questionable register.

:STATus:QUEStionable:NTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:NTRansition <numeric_value>` `:STATus:QUEStionable:NTRansition?`
Example:	`:STAT:QUES:NTR 16`
Notes:	Questionable Negative Transition This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.STAT:QUES:NTR 16 Temperature summary 'questionable cleared' will be reported to the Status Byte Register.

:STATus:QUEStionable:POWer:CONDition? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:POWer:CONDition?`
Example:	`:STAT:QUES:POW:COND?`
Notes:	This query returns the decimal value of the sum of the bits in the Questionable Power Condition register.The data in this register is continuously updated and reflects the current conditions.

:STATus:QUEStionable:POWer:ENABle command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:POWer:ENABle <numeric_value>` `:STATus:QUEStionable:POWer:ENABle?`
Example:	`:STAT:QUES:POW:ENAB 32`
Notes:	Questionable Power Enable. This command determines which bits in the Questionable Power Condition Register will set bits in the Questionable Power Event register, which also sets the Power Summary bit (bit 3) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable. STAT:QUES:POW:ENAB 32 50 MHz Input Pwr too High for Cal will be reported to the Power Summary of the Status Questionable register.

:STATus:QUEStionable:POWer[:EVENt]? query

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:POWer[:EVENt]?`
Example:	`:STAT:QUES:POW?`
Notes:	Questionable Power Event Query. This query returns the decimal value of the sum of the bits in the Questionable Power Event register.The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

:STATus:QUEStionable:POWer:NTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:POWer:NTRansition <numeric_value>` `:STATus:QUEStionable:POWer:NTRansition?`
Example:	`:STAT:QUES:POW:NTR 32`
Notes:	Questionable Power Negative Transition This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable. STAT:QUES:POW:NTR 32 50 MHz Input Power became OK for Cal will be reported to the Power Summary of the Status Questionable register.

:STATus:QUEStionable:POWer:PTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:POWer:PTRansition <numeric_value>` `:STATus:QUEStionable:POWer:PTRansition?`
Example:	`:STAT:QUES:POW:PTR 32`
Notes:	Questionable Power Positive Transition This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable. STAT:QUES:POW:PTR 32 50 MHz Input Power became too high for Cal will be reported to the Power Summary of the Status Questionable register.

:STATus:QUEStionable:PTRansition command

User Interface:	(Command only)
Command:	`:STATus:QUEStionable:PTRansition <numeric_value>` `:STATus:QUEStionable:PTRansition?`
Example:	`:STAT:QUES:PTR 16`
Notes:	Questionable Positive Transition This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable. STAT:QUES:PTR 16 Temperature summary 'questionable asserted' will be reported to the Status Byte Register.

:SYSTem:APPLication Commands

:SYSTem:APPLication:DISPlay:ENABle command

User Interface:	(Command only)
Command:	`:SYSTem:APPLication:DISPlay:ENABle OFF|ON|0|1` `:SYSTem:APPLication:DISPlay:ENABle?`
Example:	`:SYST:APPL:DISP:ENAB ON`
Notes:	Enable or disable the display. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SYSTem:APPLication:RECall:LAYout command

User Interface:	System Configurations > Misc > Recall Layout
Command:	`:SYSTem:APPLication:RECall:LAYout OFF|ON|0|1` `:SYSTem:APPLication:RECall:LAYout?`
Example:	`:SYST:APPL:REC:LAY ON`
Notes:	Enable or disable Recall Layout mode. In this mode, recalling a state by sending the `:MMEMory:LOAD:STATe` command will recall the entire layout of windows within the display, not just the source and measurement settings. Recalling a state in this mode takes a little longer. Send 1 or ON to enable; send 0 or OFF to disable. The query returns the current state.

:SYSTem:APPLication:SIMulation[:STATe] command

User Interface:	System Configurations > Misc > Simulation State
Command:	`:SYSTem:APPLication:SIMulation[:STATe] OFF|ON|0|1` `:SYSTem:APPLication:SIMulation[:STATe]?`
Example:	`:SYST:APPL:SIM ON`
Notes:	Simulation State. Enable or disable simulation state of the system

:SYSTem:COMMunicate Commands

:SYSTem:COMMunicate:LAN:ADDRess command

User Interface:	(Command only)
Command:	`:SYSTem:COMMunicate:LAN:ADDRess <quoted_string>` `:SYSTem:COMMunicate:LAN:ADDRess?`
Example:	`:SYST:COMM:LAN:ADDR "xx.xx.xx.xx"`
Notes:	Set/get the IP address of the instrument (may require Administrator privileges).

:SYSTem:COMMunicate:LAN:DGATeway command

User Interface:	(Command only)
Command:	`:SYSTem:COMMunicate:LAN:DGATeway <quoted_string>` `:SYSTem:COMMunicate:LAN:DGATeway?`
Example:	`:SYST:COMM:LAN:DGAT "xx.xx.xx.xx"`
Notes:	Set/get the gateway of the instrument (may require Administrator privileges).

:SYSTem:COMMunicate:LAN:DHCP

User Interface:	(Command only)
Command:	`:SYSTem:COMMunicate:LAN:DHCP OFF|ON|0|1` `:SYSTem:COMMunicate:LAN:DHCP?`
Example:	`:SYST:COMM:LAN:DHCP ON`
Notes:	Set/get the DHCP state of the instrument (may require Administrator privileges).

:SYSTem:COMMunicate:LAN:HNAMe? query

User Interface:	(Command only)
Command:	`:SYSTem:COMMunicate:LAN:HNAMe?`
Example:	`:SYST:COMM:LAN:HNAM?`
Notes:	Get the hostname of the instrument.

:SYSTem:COMMunicate:LAN:MAC? query

User Interface:	(Command only)
Command:	`:SYSTem:COMMunicate:LAN:MAC?`
Example:	`:SYST:COMM:LAN:MAC?`
Notes:	Get the MAC address of the instrument.

:SYSTem:COMMunicate:LAN:SMASk command

User Interface:	(Command only)
Command:	`:SYSTem:COMMunicate:LAN:SMASk <quoted_string>` `:SYSTem:COMMunicate:LAN:SMASk?`
Example:	`:SYST:COMM:LAN:SMAS "xx.xx.xx.xx"`
Notes:	Set/get the subnet mask of the instrument (may require Administrator privileges).

:SYSTem:DATE Command

User Interface:	(Command only)
Command:	`:SYSTem:DATE <year>,<month>,<day>` `:SYSTem:DATE?`
Example:	`:SYST:DATE 2016,7,25`
Notes:	Set or get the system date in the format <year>,<month>,<day>.

:SYSTem:ERRor Queries

:SYSTem:ERRor:COUNt? query

User Interface:	(Command only)
Command:	`:SYSTem:ERRor:COUNt?`
Example:	`:SYST:ERR:COUN?`
Notes:	Get the number of errors stored in the error queue.

:SYSTem:ERRor[:NEXT]? query

User Interface:	(Command only)
Command:	`:SYSTem:ERRor[:NEXT]?`
Example:	`:SYST:ERR?`
Notes:	Get the errors that are stored in the error queue one by one. The oldest error will be returned first (at the same time, it is removed from the error queue.).

:SYSTem:ERRor:PUP? query

User Interface:	(Command only)
Command:	`:SYSTem:ERRor:PUP?`
Example:	`:SYST:ERR:PUP?`
Notes:	Get the power up (startup) errors. This is equivalent to `:SYSTem:ERRor:PUP:DETails?`, except that less detailed information about the errors is provided.This type of error will not be cleared by *CLS.

:SYSTem:ERRor:PUP:DETails? query

User Interface:	(Command only)
Command:	`:SYSTem:ERRor:PUP:DETails?`
Example:	`:SYST:ERR:PUP:DET?`
Notes:	Get the power up (startup) errors, with details. This is equivalent to `:SYSTem:ERRor:PUP?`, except that more information about the errors is provided. (For example, in the case of an "FPGA unmatched" error, information is provided about the current FPGA version, the required FPGA version, and which boards have an unmatched FPGA. This type of error will not be cleared by *CLS.

:SYSTem:HELP:HEADers Query

User Interface:	(Command only)
Command:	`:SYSTem:HELP:HEADers?`
Example:	`:SYST:HELP:HEAD?`
Notes:	Outputs a list of the valid SCPI commands for the currently selected Mode.The output is an IEEE Block format with each command separated with the New-Line character (hex 0x0A).

:SYSTem:HID Query

User Interface:	(Command only)
Command:	`:SYSTem:HID?`
Example:	`:SYST:HID?`
Notes:	Opens the license explorer.

:SYSTem:LKEY Commands

:SYSTem:LKEY command

User Interface:	(Command only)
Command:	`:SYSTem:LKEY <"OptionInfo">, <"LicenseInfo">` `:SYSTem:LKEY? <"OptionInfo">`

Example:	`:SYST:LKEY "E7760A-RF2", "012EEAF7311D4932B1E40E93F6B96F12C8B551FF2701EA3108985B94770E92396D48FF0966BAD69F3500,10-oct-2016"`
	
	`:SYST:LKEY? "E7760A-RF2"`

Notes:	Add the specified license. The <"OptionInfo"> identifies the 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. The query returns the license information about the existing license key.

:SYSTem:LKEY:DELete command

User Interface:	(Command only)
Command:	`:SYSTem:LKEY:DELete`
Example:	`:SYST:LKEY:DEL "E7760A-RF2", "012EEAF7311D4932B1E40E93F6B96F12C8B551FF2701EA3108985B94770E92396D48FF0966BAD69F3500,10-oct-2016"`
Notes:	Delete the specified license. The <"OptionInfo"> identifies the 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 reverse compatibility.

:SYSTem:LKEY:LIST? query

User Interface:	System > System Information > Licenses
Command:	`:SYSTem:LKEY:LIST?`
Example:	`:SYST:LKEY:LIST?`

Notes:	Return a list of licenses.
	Return Value: an <arbitrary block data> of all the installed instrument licenses. <arbitrary block data> is: `#NMMM <data>`
	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> is the ASCII contents of the data.
	The format of each license is: <Feature>,<Version>,<Signature>,<Expiration Date>,<Serial Number for Transport (if transportable)>
	
	Return Value Example:
	`#3460«x0D»`
	`E7760A-RF2,1.000,012EEAF7311D4932B1E40E93F6B96F12C8B551FF2701EA310`
	`8985B94770E92396D48FF0966BAD69F3500,10-oct-2016`
	`«x0D»`
	`E7760A-RF3,1.000,01AF189B0F3C67D550D9E32703787BF3022F16EEBA02E44E0`
	`40C25F5FD569EF529A0CAB044C9C6B4328D,10-oct-2016`
	`«x0D»`
	`Y7707A-1FY,1.000,029EEB71D9D07209D35457212E5608FE65284F9412039D6B2`
	`BE75698E093A3B7883B4F17C25762757B5E,10-oct-2016`

:SYSTem:LOFF command

User Interface:	(Command only)
Command:	`:SYSTem:LOFF`
Example:	`:SYST:LOFF`
Notes:	Terminate all open Windows applications and log off the current user. This is equivalent to performing the Windows command “shutdown –l –f –t0”. This command initiates an immediate log off of the current user. Because it exits the instrument application, any unsaved measurement result will be lost. You cannot use *WAI or *OPC? to synchronize operation. In addition to the instrument application, all other Windows programs will be terminated without the opportunity to save any work in progress. The instrument will require human interaction to perform a Log In to regain instrument operation.

:SYSTem:PDOWn command

User Interface:	(Command only)
Command:	`:SYSTem:PDOWn [NORMal|FORCe]`
Example:	`:SYST:PDOW`
Notes:	Shuts down the instrument in the normal way (NORMal) or forced way (FORCe). In case there is another application with modified data pending for saving, the application prompt the user. The system waits until the user responds in the normal mode. It will go off after 20 seconds of wait in the force mode and all data will be lost. Options spelled as Normal and Force in SCPI command reference

:SYSTem:PRESet Commands

:SYSTem:PRESet:ANALyzer command

User Interface:	(Command only)
Command:	`:SYSTem:PRESet:ANALyzer`
Example:	`:SYST:PRES:ANAL`
Notes:	This will set all the analyzer related settings back to default values.

:SYSTem:PRESet:SOURce command

User Interface:	(Command only)
Command:	`:SYSTem:PRESet:SOURce`
Example:	`:SYST:PRES:SOUR`
Notes:	This will set all the source related settings back to default values.

:SYSTem:PUP Commands

:SYSTem:PUP command

User Interface:	(Command only)
Command:	`:SYSTem:PUP [Normal|Force]`
Example:	`:SYST:PUP`
Notes:	Terminate all open Windows applications and reboot the instrument. Any unsaved measurement result will be lost. You cannot use *WAI or *OPC? to synchronize operation. In addition to the instrument application, all other Windows programs will be terminated without the opportunity to save any work in progress

:SYSTem:PUP:PROCess command

User Interface:	(Command only)
Command:	`:SYSTem:PUP:PROCess`
Example:	`:SYST:PUP:PRO`
Notes:	Restart the instrument. You must wait after this command for the instrument application to restart. 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.

:SYSTem:TIME Command

User Interface:	(Command only)
Command:	`:SYSTem:TIME <hour>,<minute>,<second>` `:SYSTem:TIME?`
Example:	`:SYST:TIME 16,1,45`
Notes:	Set or get the system time in the format <hour>,<minute>,<second>. The hour is in 24-hour format.

:SYSTem:VERSion Query

User Interface:	(Command only)
Command:	`:SYSTem:VERSion?`
Example:	`:SYST:VERS?`
Notes:	Return the SCPI version number with which the instrument complies. Example return: `1999.0`

:TRIGger:HW Commands

:TRIGger:HW:DELay command

User Interface:	Acquisition Settings > Hard ware Trigger > Delay
Command:	`:TRIGger:HW:DELay <delay>` `:TRIGger:HW:DELay?`
Example:	`:TRIG:HW:DEL .1`
Notes:	Get/set the trigger delay in seconds. The default value is -1 µs. The range is -1 ms to +1 ms. The length of a negative delay cannot exceed the setting for `:SENSe:TIME:LENGth`.

:TRIGger:HW:EXTernal:LEVel command

User Interface:	Acquisition Settings > Hard ware Trigger > Ext Level
Command:	`:TRIGger:HW:EXTernal:LEVel <level>` `:TRIGger:HW:EXTernal:LEVel?`
Example:	`:TRIGr:HW:EXT:LEV 3.8`
Notes:	Get/set the external trigger level, in V. Default setting: 0. Range: 0 to 5.

:TRIGger:HW:HOLDoff:STATe command

User Interface:	Acquisition Settings > Hard ware Trigger > Holdoff On
Command:	`:TRIGger:HW:HOLDoff:STATe OFF|ON|0|1` `:TRIGger:HW:HOLDoff:STATe?`
Example:	`:TRIG:HW:HOLD:STAT ON`
Notes:	Get/set the trigger holdoff state. The default setting is Off.

:TRIGger:HW:HOLDoff:TIME command

User Interface:	Acquisition Settings > Hard ware Trigger > Holdoff Time
Command:	`:TRIGger:HW:HOLDoff:TIME <time>` `:TRIGger:HW:HOLDoff:TIME?`
Example:	`:TRIG:HW:HOLD:TIME .4`
Notes:	Get/set the trigger holdoff time in seconds. Default setting: 2 µs. Range: 0 to 1 ms.

:TRIGger:HW:HOLDoff:TYPE command

User Interface:	Acquisition Settings > Hard ware Trigger > Holdoff Type
Command:	`:TRIGger:HW:HOLDoff:TYPE BELow|ABOVe` `:TRIGger:HW:HOLDoff:TYPE?`
Example:	`:TRIG:HW:HOLD:TYPE BEL`
Notes:	Get/set the trigger holdoff type. Default setting: BELow.

:TRIGger:HW:MAGnitude:LEVel command

User Interface:	Acquisition Settings > Hard ware Trigger > Mag Level
Command:	`:TRIGger:HW:MAGnitude:LEVel <numeric_value>` `:TRIGger:HW:MAGnitude:LEVel?`
Example:	`:TRIG:HW:MAG:LEV -10`
Notes:	Get/set the magnitude trigger level in dBm, if the trigger style selected is Video or RFBurst (see the `:TRIGger:HW:STYLe` command). Default setting: -20. Range: -60 to +10.

:TRIGger:HW:MAGnitude:LEVel:AUTO command

User Interface:	Acquisition Settings > Hard ware Trigger > Mag Level Auto
Command:	`:TRIGger:HW:MAGnitude:LEVel:AUTO 0|1` `:TRIGger:HW:MAGnitude:LEVel:AUTO?`
Example:	`:TRIG:HW:MAG:LEV:AUTO`
Notes:	Specify 0 to disable (the default state), 1 to enable. Enable or disable the automatic setting of the trigger Mag Level when the Range setting is changed.

:TRIGger:HW:MAGnitude:LEVel:OFFSet command

User Interface:	Acquisition Settings > Hard ware Trigger > Mag Level Offset
Command:	`:TRIGger:HW:MAGnitude:LEVel:OFFSet <dB>` `:TRIGger:HW:MAGnitude:LEVel:OFFSet?`
Example:	`:TRIG:HW:MAG:LEV:OFFSet -10`
Notes:	Enter the offset in dB from the Range setting at which the Mag Level of the trigger will occur, if the Mag Level Auto setting (see above) is True. The default setting is -10 dB. The range is -100 to +100.

:TRIGger:HW:STYLe command

User Interface:	Acquisition Settings > Hard ware Trigger > Style
Command:	`:TRIGger:HW:STYLe AUTO|VIDeo|RFBurst|EXTernal1|INTernal` `:TRIGger:HW:STYLe?`
Example:	`:TRIG:HW:STYL AUTO`
Notes:	Get/set the trigger style. (AUTO is equivalent to Free Run.) The default is AUTO. If External is selected, the external trigger signal must applied to the TRIG 1 connector on the E7760A rear panel.

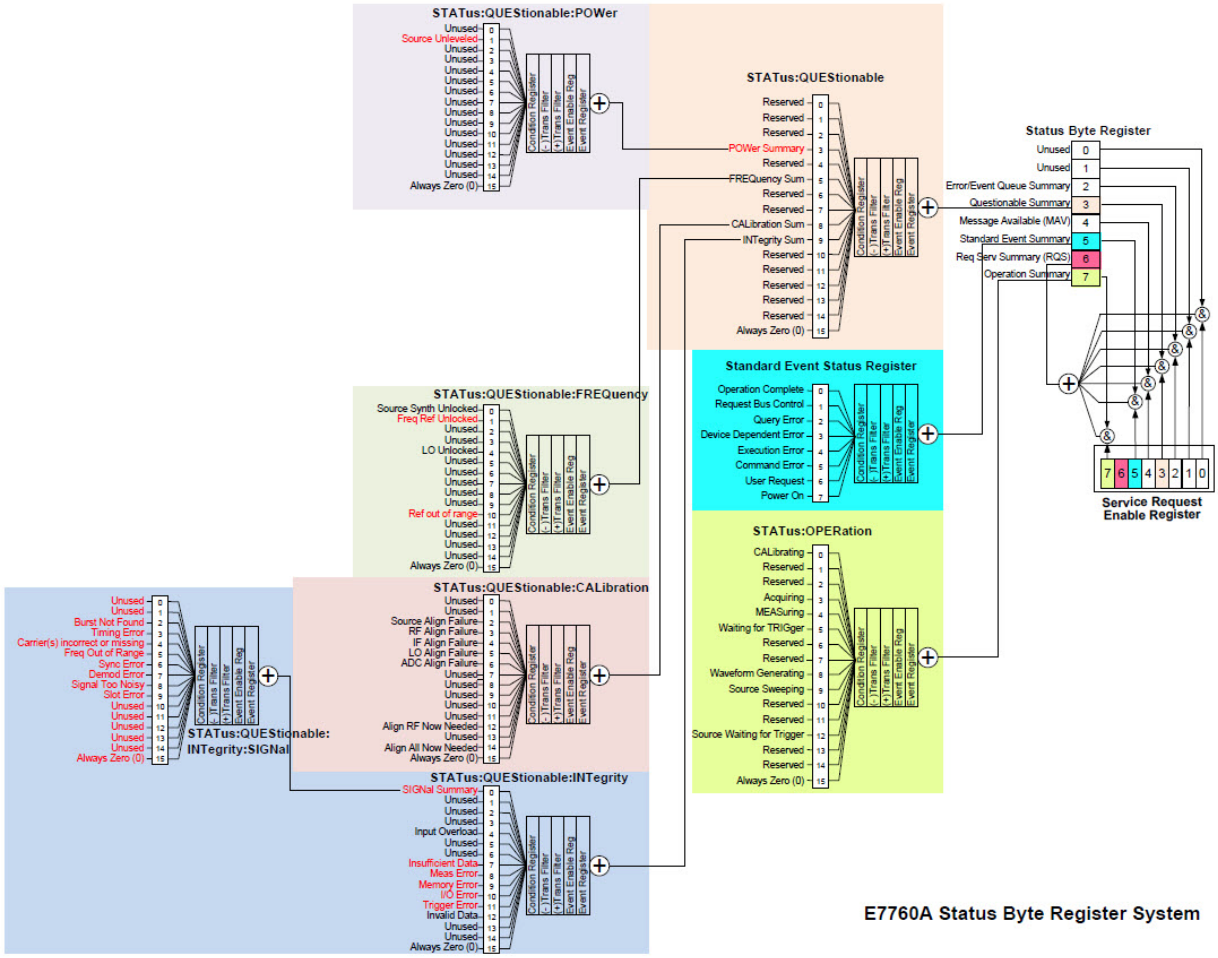
5 System Information

The following topics can be found in this section:

Status Registers

The status register system as a whole is illustrated below.

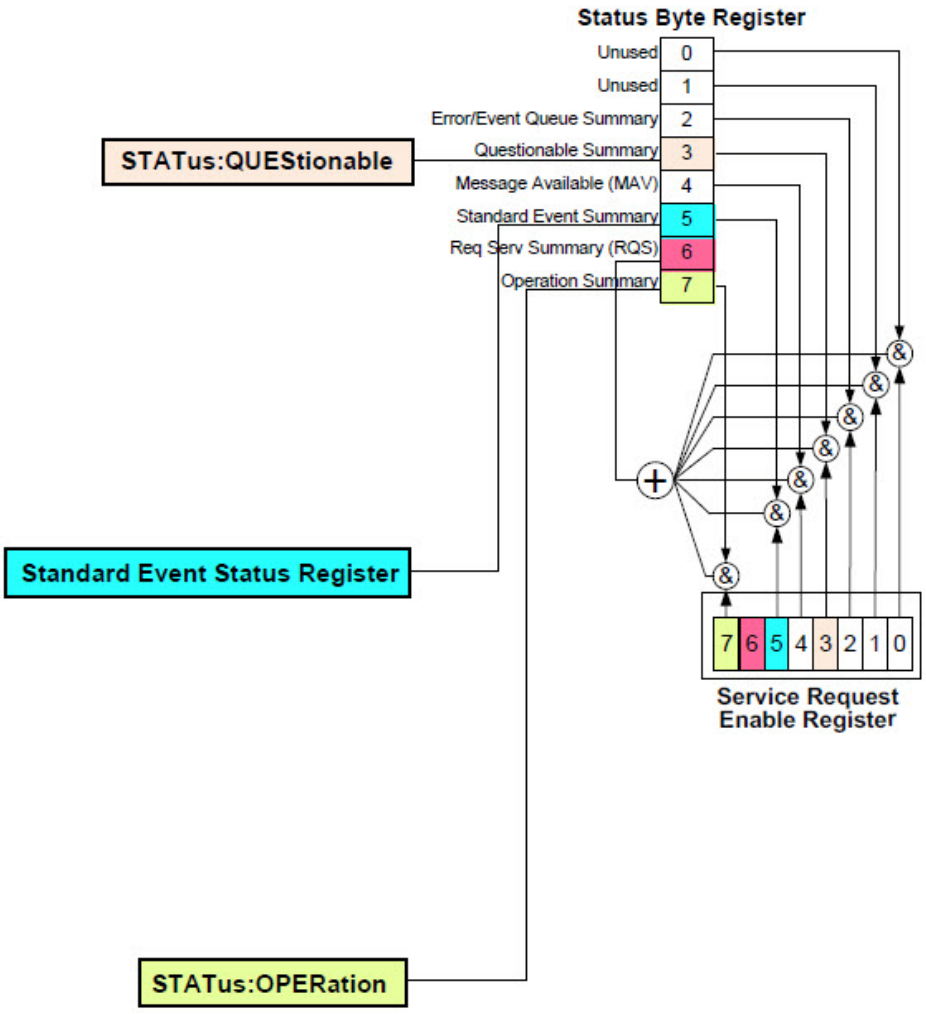
Figure 5-1 Overall view of the status register system



Status Byte Register

The Status Byte Register is illustrated below.

Figure 5-2 Status Byte Register

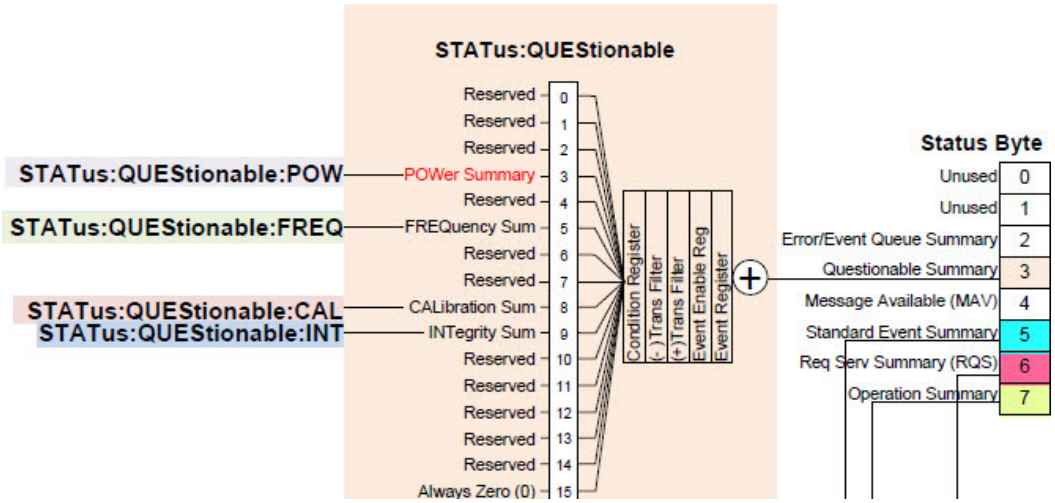


Bit	Description
0 - 1	Unused
2	Error/Event Cue Summary
3	Questionable Summary (see “STATus:QUEStionable Register” on page 289)
4	Message Available (MAV)
5	Standard Event Summary (see “Standard Event Status Register” on page 295)
6	Req Serv Summary (RQS)
7	Operation Summary (see “STATus:OPERation Register” on page 296)

STATus:QUEStionable Register

The STATus:QUEStionable register is illustrated below.

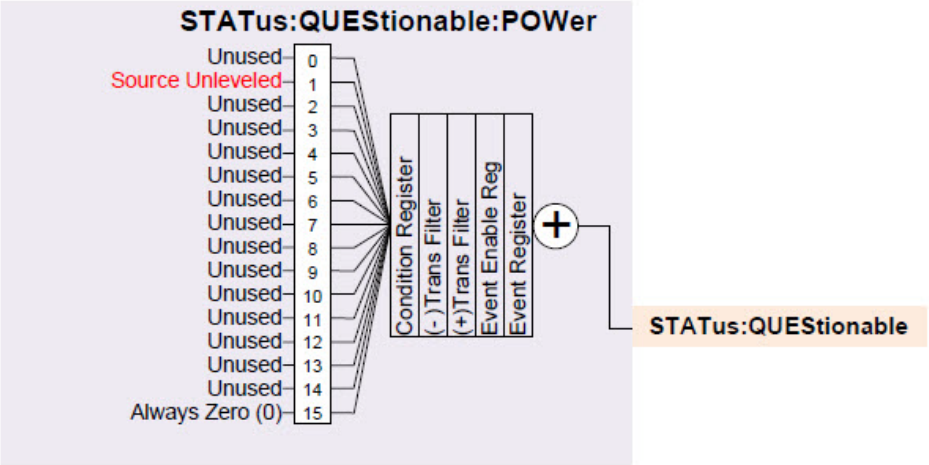
Figure 5-3 Status Questionable Register



Bit	Description	Bit	Description
0 -2	Reserved	8	CALibration Sum (see "STATus:QUEStionable :CALibration" on page 292)
3	POWer Summary (see "STATus:QUEStionable :POWer" on page 290)	9	INTegrity Sum (see "STATus:QUEStionable :INTegrity" on page 293)
4	Reserved	10 - 14	Reserved
5	FREQuency Summary (see "STATus:QUEStionable :FREQuency" on page 291)	15	Always Zero
6 -7	Reserved		

STATus:QUEStionable:POWer

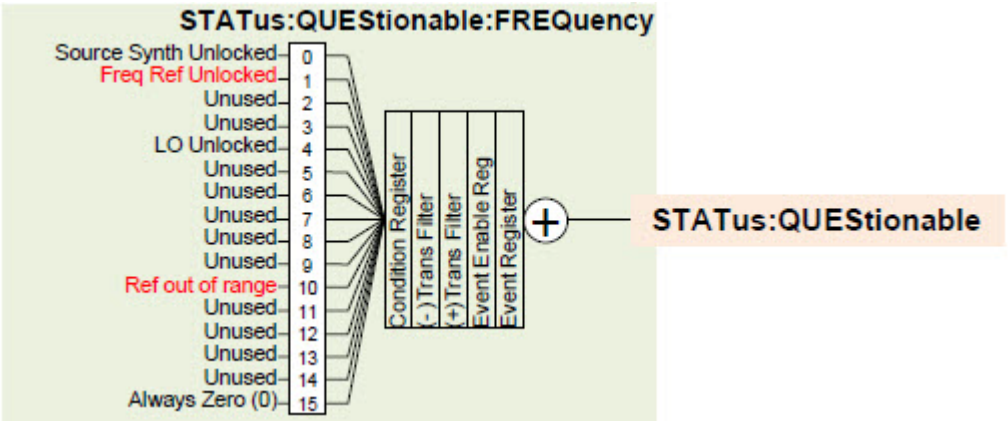
Figure 5-4 STATus:QUEStionable:POWer



Bit	Description	Bit	Description
0	Unused	8 - 14	Unused
1	Source Unleveled	15	Always Zero
2-7	Reserved		

STATus:QUEStionable:FREQuency

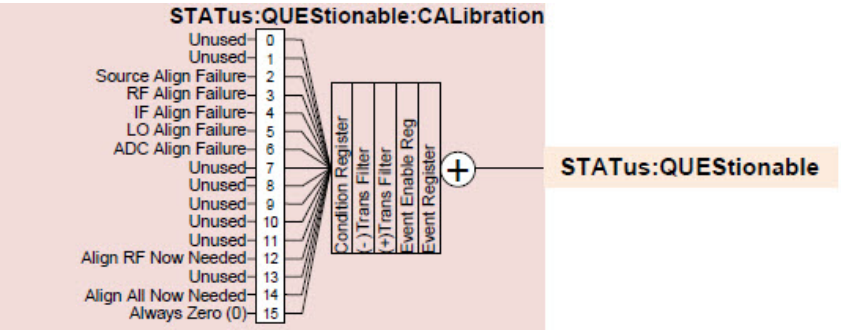
Figure 5-5 STATus:QUEStionable:FREQuency



Bit	Description	Bit	Description
0	Source Synth Unlocked	8 - 9	Unused
1	Freq Ref Unlocked	10	Ref out of range
2 - 3	Unused	11 - 14	Unused
4	LO Unlocked	15	Always Zero
5 - 7	Unused		

STATus:QUEStionable:CALibration

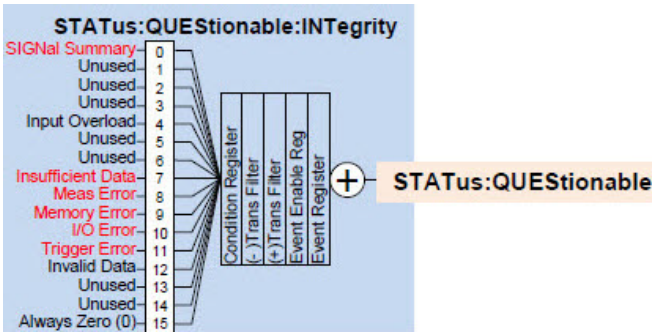
Figure 5-6 STATus:QUEStionable:CALibration



Bit	Description	Bit	Description
0 -1	Unused	8 -11	Unused
2	Source Align Failure	12	Align RF Now Needed
3	RF Align Failure	13	Unused
4	IF Align Failure	14	Align All Now Needed
5	LO Align Failure	15	Always Zero
6	ADC Align Failure		
7	Unused		

STATus:QUEStionable:INTegrity

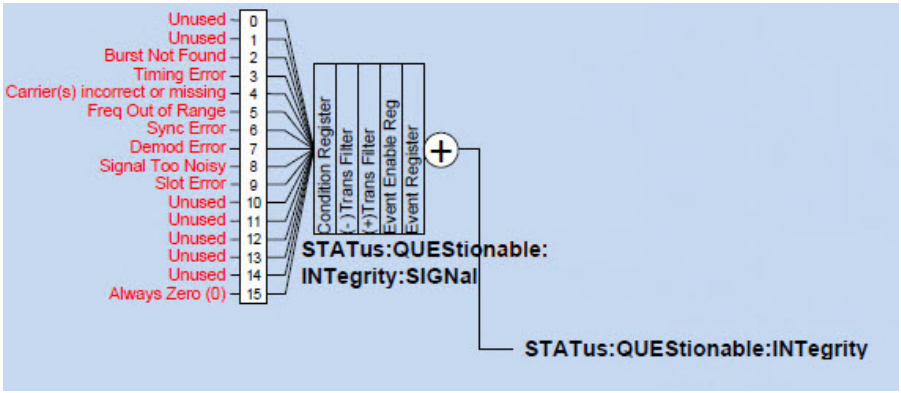
Figure 5-7 STATus:QUEStionable:INTegrity



Bit	Description	Bit	Description
0	Signal Summary (see “STATus:QUEStionable :INTegrity:SIGNal” on page 294)	8	Meas Error
1 - 3	Unused	9	Memory Error
4	Input Overload	10	I/O Error
5 - 6	Unused	11	Trigger Error
7	Insufficient Data	12	Invalid Data
		13 - 14	Unused
		15	Always Zero

STATus:QUEStionable:INTegrity:SIGNal

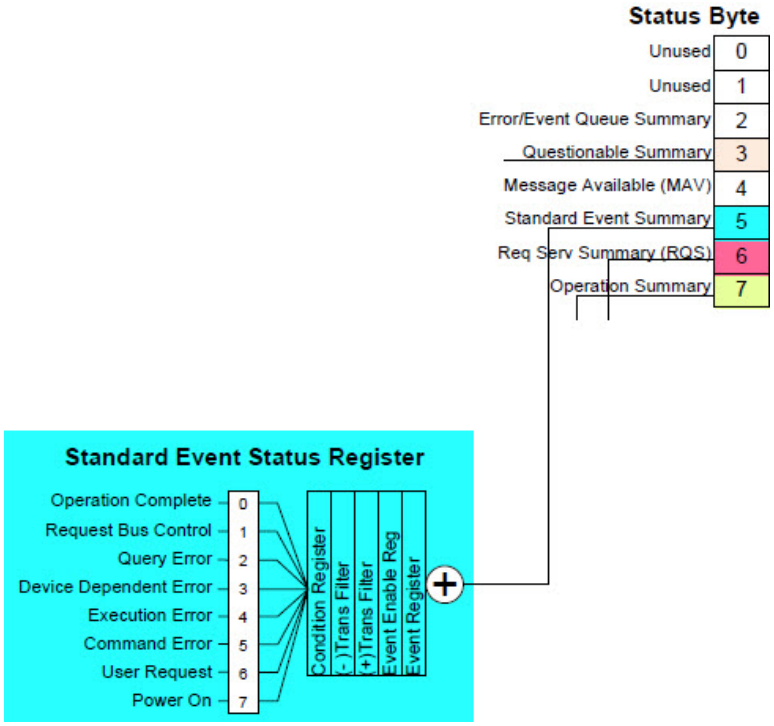
Figure 5-8 STATus:QUEStionable:INTegrity:SIGNal



Bit	Description	Bit	Description
0 -1	Unused	8	Signal Too Noisy
2	Burst Not Found	9	Slot Error
3	Timing Error	10 - 14	Unused
4	Carrier(s) incorrect or missing	15	Always Zero
5	Freq Out of Range		
6	Sync Error		
7	Demod Error		

Standard Event Status Register

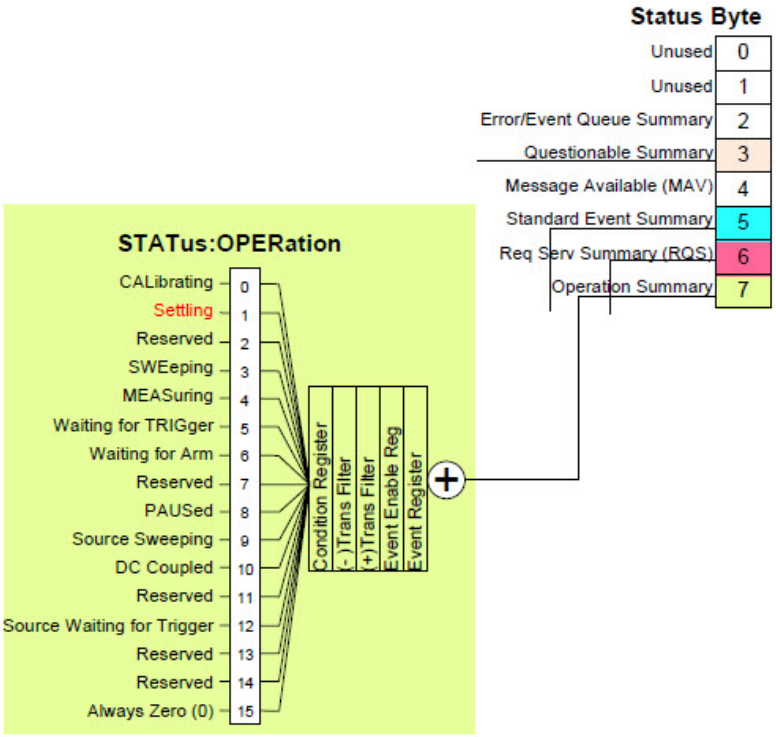
Figure 5-9 Standard Event Status Register



Bit	Description
0	Operation Complete
1	Request Bus Control
2	Query Error
3	Device Dependent Error
4	Execution Error
5	Command Error
6	User Request
7	Power On

STATus:OPERation Register

Figure 5-10 STATus:OPERation Register



Bit	Description	Bit	Description
0	CALibrating	8	Waveform Generating
1 - 2	Reserved	9	Source Sweeping
3	Acquiring	10 - 11	Reserved
4	MEASuring	12	Source Waiting for Trigger
5	Waiting for TRIGger	13 - 14	Reserved
6 - 7	Reserved	15	Always Zero

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