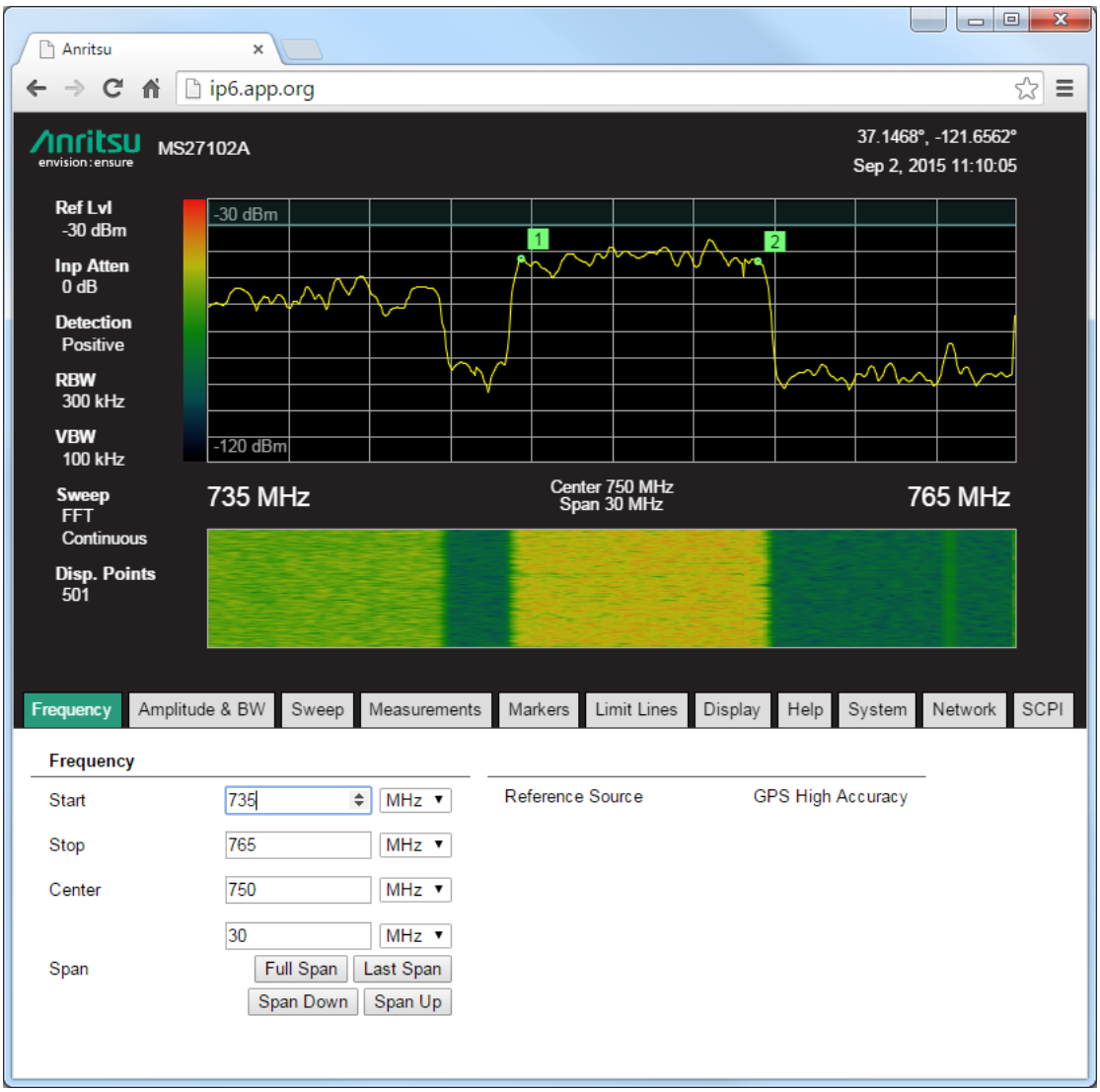
User Guide

Remote Spectrum Monitor

MS27100, MS27101A, MS27102A, MS27103A
9 kHz to 6 GHz



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Part Number: 10580-00419
Revision: N
Published: December 2021

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Chapter 1 — General Information

1-1 Introduction

This Remote Spectrum Monitor (RSM) User Guide is part of a set of manuals that describe all of the instrument functions and their use. This manual covers the instrument overview, system functions, programming, and other common features, along with a brief guide to basic measurement concepts and setups.

1-2 Additional Documentation

Instrument operations are explained in the document types listed below. Read the Handheld Instruments Product Information, Compliance, and Safety Guide (PN: 10100-00064) for important safety, legal, and regulatory notices before operating the equipment. For additional information and literature covering your product, visit the product page of your instrument and select the Library tab.

Table 1-1. Additional Documentation

Document Part Number	Description
10100-00064	Important Product Information, Compliance, and Safety Notices
10450-00045	MX280007 Mobile Interference Hunter Help
10450-00062	MX280001A Vision Help
10450-00068	MX280005 Vector Signal Analysis Help
10580-00409	MS2710xA Remote Spectrum Monitor Installation Guide
10580-00414	MS2710xA Quick Start Guide
10580-00416	MX280007 Mobile Interference Hunter User Guide
10580-00417	MX280001A Vision Quick Start Guide
10580-00418	MX280001A Vision User Guide
10580-00420	MS2710xA Maintenance Manual
10580-00435	MX280001A Vision API Programming Manual
10580-00470	MS27101A-IBCM, MA8100A, Quick Start Guide
10580-00475	MX280005 Vector Signal Analysis User Guide
11410-00853	MS27101A Indoor Remote Spectrum Monitor Technical Data Sheet
11410-00847	MS27102A Outdoor Remote Spectrum Monitor Technical Data Sheet
11410-00854	MS27103A Remote Spectrum Monitor Technical Data Sheet
11410-00898	MS27100A Spectrum Monitor Module Technical Data Sheet

Table 1-2. MS2710xA Product Pages

MS27100A	https://www.anritsu.com/en-us/test-measurement/products/ms27100a
MS27101A	https://www.anritsu.com/en-us/test-measurement/products/ms27101a
MS27102A	https://www.anritsu.com/en-us/test-measurement/products/ms27102a
MS27103A	https://www.anritsu.com/en-us/test-measurement/products/ms27103a

1-3 Remote Spectrum Monitor System Description

Spectrum monitoring systems facilitate the identification and removal of interference signals that degrade network capacity. By monitoring spectrum on a continual basis, problem signals can be identified as they occur in real time. In addition to interference detection, spectrum monitoring is also used to identify the types of signals present in the environment, characterize signal quality, and continuously scan for signal activity.

RSM systems are further enhanced with software applications that include:

- TETRA/SAT analysis
- High-Speed Port Scanner
- Database collection and interrogation
- Spectrum health reporting
- Geo-location of signals
- Power of Arrival
- Time Difference and Angle of Arrival

Anritsu offers three models of remote spectrum monitoring products, designed to both mitigate interference problems and to identify illegal or unlicensed signal activity. These spectrum monitoring components described in this User Guide provide interference detection, identification, and characterization of interfering signal(s).

- MS27100A – OEM Module (Available for Customer customized design enclosure)
- MS27101A – Indoor Module for RSM Applications
- MS27102A – Outdoor Module for RSM Applications
- MS27103A – A multi-port RF input monitoring system

Available Options

Refer to the MS2710xA TDS for performance specifications, additional features, available options and accessories.

1-4 Connecting to the RSM

Connect the RSM directly to the PC using a crossover cable. Turn off any Wi-Fi connectivity to your PC and configure its Ethernet IP settings corresponding to the default factory settings of the Anritsu remote spectrum monitor. Once a direct Ethernet connection to the instrument is established, it can be manually operated using a browser-based graphical user interface (GUI) that is hosted on the instrument, or the instrument can be controlled via SCPI command programming. The embedded GUI facilitates access to all instrument features and their controls, in addition to live display of measurement data. The GUI provides Help content that covers both manual and programmatic means of operation. Click the Help tab to open links for each topic. For more information on setting up the remote spectrum monitor, PC, and Ethernet communication, see Chapter 3, “Setting Up Communication”.

Set the Ethernet IP corresponding to default factory settings of the RSM with the following IP configuration:

- **DHCP:** OFF (Static IP Address)
- **Static IP Address:** 10.0.0.2
- **Static Subnet:** 255.255.255.0
- **Static Gateway:** 10.0.0.0

Note	Designed for use with HTML5 compliant browsers. Google Chrome version 44 and Mozilla Firefox version 40 have been verified for full feature support.

1-5 Instrument Care and Preventive Maintenance

The Remote Spectrum Monitor preventive maintenance consists of cleaning the unit and inspecting and cleaning the RF connectors on the instrument and on all accessories. Clean the instrument with a soft, lint-free cloth dampened with water or with water and a mild cleaning solution.

Caution	To avoid damaging the display or case, do not use solvents or abrasive cleaners.

Connector Care

Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of the N(f) connectors and the pins of the N(m) connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are undamaged, gauge the connectors to confirm that the dimensions are correct. Visually inspect the test port cable(s). The test port cable should be uniform in appearance, and not stretched, kinked, dented, or broken.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-N connectors. The recommended torque is 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m). Inadequate torque settings can affect measurement accuracy. Over-tightening connectors can damage the cable, the connector, the instrument, or all of these items.

Visually inspect connectors for general wear, cleanliness, and for damage such as bent pins or connector rings. Repair or replace damaged connectors immediately. Dirty connectors can limit the accuracy of your measurements. Damaged connectors can harm the instrument. Connection of cables carrying an electrostatic potential, excess power, or excess voltage can damage the connector, the instrument, or both.

Connecting Procedure

1. Carefully align the connectors. The male connector center pin must slip concentrically into the contact fingers of the female connector.
2. Push connectors straight together. Do not twist or screw them together. A slight resistance can usually be felt as the center conductors mate.
3. To tighten, turn the connector nut, not the connector body. Major damage can occur to the center conductor and to the outer conductor if the connector body is twisted.
4. If you use a torque wrench, initially tighten by hand so that approximately 1/8 turn or 45 degrees of rotation remains for the final tightening with the torque wrench.

   Relieve any side pressure on the connection (such as from long or heavy cables) in order to assure consistent torque. Use an open-end wrench to keep the connector body from turning while tightening with the torque wrench.

   Do not over-torque the connector.

Disconnecting Procedure

1. If a wrench is needed, use an open-end wrench to keep the connector body from turning while loosening with a second wrench.
2. Complete the disconnection by hand, turning only the connector nut.
3. Pull the connectors straight apart without twisting or bending.

RF Input Warning

The RSM components are sensitive measuring instruments designed to measure low power levels. Avoid damaging this sensitive circuitry by observing the maximum input levels printed on the instrument connector labeling and specified in the product technical data sheet. Do not exceed the specified RF power at the RF input. Damage caused by exceeding input power limits is not covered under warranty.

Be sure to review the product technical data sheet or Anritsu website for recommended components and accessories that can help you protect your instrument. These include a variety of adapters, attenuators, filters, and RF detection accessories.

ESD Caution

The Remote Spectrum Monitoring system components, like other high performance instruments, is susceptible to ESD (electrostatic discharge) damage. Coaxial cables and antennas often build up a static charge, which may damage the MT8220T input circuitry (if allowed to discharge by connecting directly to the RSM without previously discharging the static charge). Operators **must be aware** of the potential for ESD damage and take all necessary precautions.

Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. Because these apply to the RSM, Anritsu Company recommends that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the RSM.

1-6 Contacting Anritsu for Sales and Service

To contact Anritsu, visit the following URL and select the services in your region:
http://www.anritsu.com/contact-us.

Chapter 2 — Remote Spectrum Monitors Overview

2-1 Introduction

This section provides an overview of the Remote Spectrum Monitor. Refer to the RSM Installation Guide for the installation and mounting instructions.

https://www.anritsu.com/en-US/test-measurement/support/downloads/manuals/dwl15377

2-2 MS27101A Overview

The MS27101A is designed for indoor rack-mount environments. Typically these MS27101A probes are positioned in a permanent or semi-permanent location for radio surveillance and monitoring. The MS27101A remote spectrum monitor can be ordered with optional rack mounting hardware that allows it to be mounted into a standard 48 cm equipment rack in either a single unit installation or a side-by-side installation.

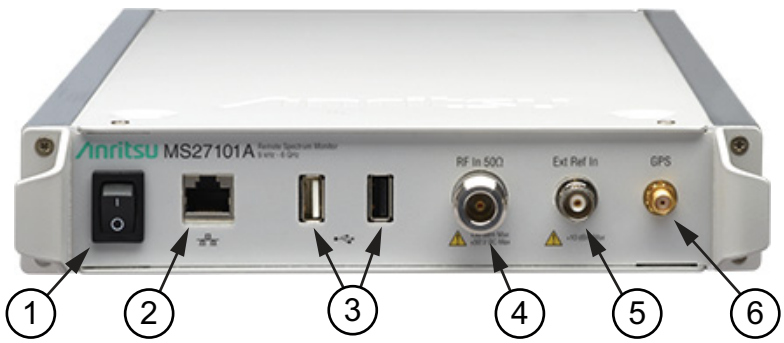
MS27101A Components

This section provides a brief overview of the instrument and the supplied accessories.

The MS27101A instrument consists of the following main components:

- MS27101A Remote Spectrum Monitor
- Indoor power supply and power cable
- Optional mounting brackets and fasteners (Option 1)

The MS27101 front panel connectors are identified in Figure 2-1.



1. Power Switch
2. Ethernet
3. USB Type A (2)
4. RF Input, N(f)
5. Reference Input, BNC
6. GPS Antenna, SMA(f)

Figure 2-1. MS27101A

2-3 MS27102A Overview

The MS27102A is designed for outdoor environments. Typically these MS27102A probes are positioned in a permanent or semi-permanent location for radio surveillance and monitoring. The MS27102A remote spectrum monitor can be ordered with optional rack mounting hardware that allows it to be mounted in a variety of wall or pole structures

The MS27102A must be installed by a trained service person who is familiar with RF system integration and local regulatory and compliance requirements for the region in which the instrument is being installed.

MS27102A Components

The MS27102A instrument consists of the following main components:

- MS27102A Remote Spectrum Monitor
- Mounting brackets and fasteners
- IP67 Ethernet and power connector glands
- Indoor power supply and power cable with assembled connector gland
- GPS antenna

The MS27102A front panel connectors are identified in Figure 2-2.

1. GPS Antenna, SMA(f)
2. No Connection
3. 3-pin Power Input
4. Ethernet
5. RF Input Port 2, N(f) (optional)
6. RF Input Port 1, N(f)

Figure 2-2. MS27102A

2-4 MS27103A Overview

The MS27103A is a multi-port RF In monitoring platform employed in systems requiring multiple antennas to cover a large frequency range. This monitor is often used with cellular infrastructure equipment with multiple sectors and multiple frequencies per sector.

The standard MS27103A Remote Spectrum Monitor requires a user supplied DC power supply with voltage rating of ±20 VDC to ±70 VDC with minimum power output of 11 W. Option 110 replaces the DC connector screw terminal with an internal AC-DC supply with a 3-pin line receptacle.

The MS27103A remote spectrum monitor module is configured with integral front panel handle and rack mounting bracket that allows it to be mounted into a standard 48 cm equipment rack.

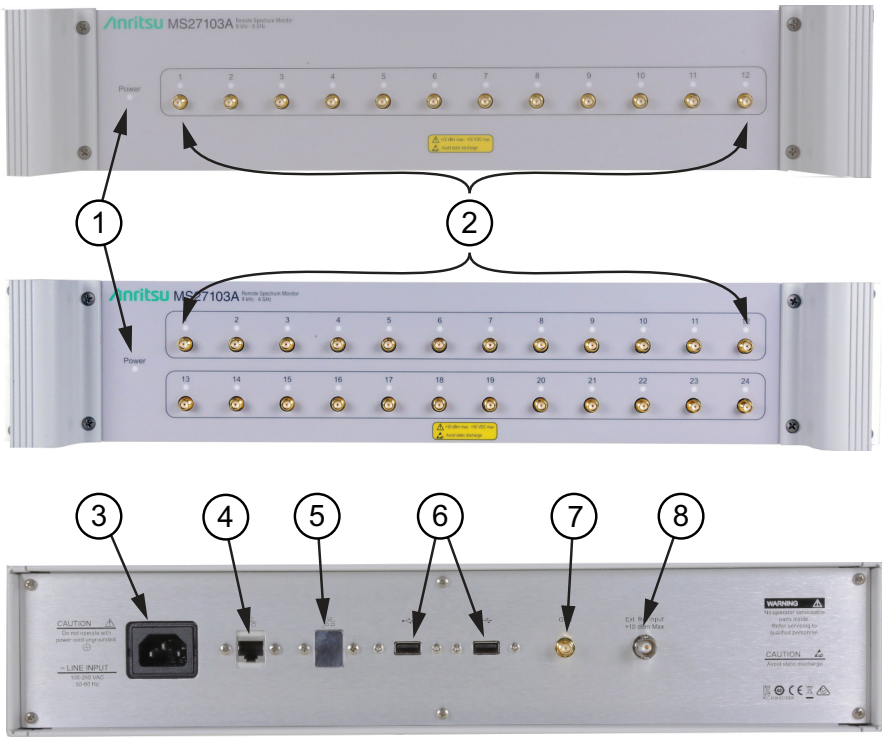
MS27103A Components

The MS27103A instrument consists of the following main components:

- MS27103A Remote Spectrum Monitor
- Ethernet Cable
- GPS antenna

The MS27103A front panel connectors are identified in Figure 2-3.

Front Panel



Rear Panel

1. Power LED	5. Ethernet Port (optional)
2. RF Input Ports, 12 or Stacked = 24 SMA(f)	6. USB Type A (2)
3. Power Input Screw Terminal (or 110 VAC line connector with Option 110)	7. GPS Antenna, SMA(f)
4. Ethernet Port	8. External Reference Input, BNC(f)

Figure 2-3. MS27103A

2-5 MS27100A Overview

The MS27100A is a remote spectrum monitor designed for OEM applications. This solution can be integrated and branded into a user's own enclosure or used as a stand-alone monitor is areas where space is minimal. The MS27100A connectors are identified in Figure 2-4. To set up PC communication with the MS27100A, see Chapter 3, "Setting Up Communication".

Optional Six-to-One Multiplexer

Option MS27100A-0406 enables a USB interface to a 6-port RF multiplexer. This option requires a six-to-one multiplexer (PN: 2000-1894-R) and a USB-A to 5-pin header cable (accessory 3-67367) that connects to the MS27100A Spectrum Monitor Module. The connection interface control is shown in Figure 2-4.

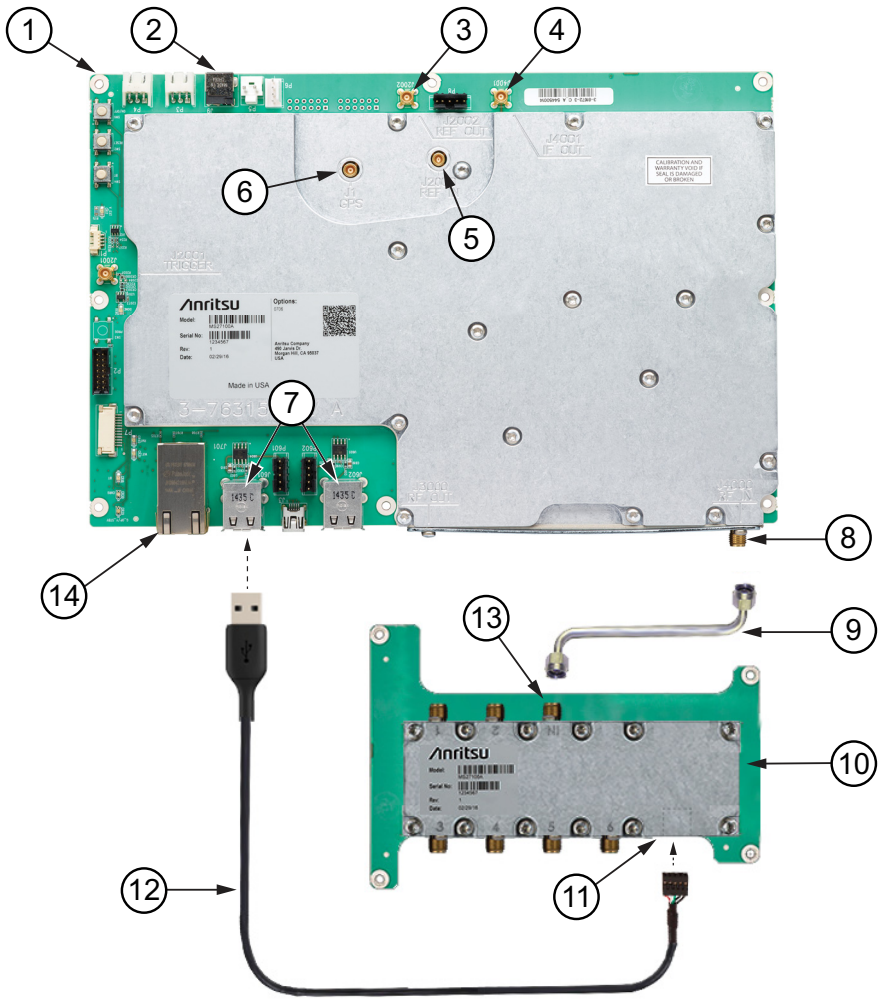


Figure 2-4. Option MS27100A-0406

1. MS27100A Module	8. MS27100A RF Input
2. External Power,11.0 to 14.5 VDC, 11 W, 5.5 mm Barrel Connector	9. Semi-Rigid Cable
3. 10 MHz Reference Output, MCX(f)	10. Six-to-One Multiplexer (PN: 2000-1894-R)
4. IF Output, MCX(f)	11. Six-to-One Multiplexer 5 pin Connector Input
5. 10 MHz Reference Input, +10 dBm max, +5 VDC max, MCX(f)	12. USB-A Connector to 5-Pin Header Connector Cable (3-63767)
6. GPS Antenna Input, MCX(f)	13. Six-to-One Multiplexer RF Output
7. USB Type A Connector Input (4)	14. Gbit Ethernet, RJ45 connector

Figure 2-4. Option MS27100A-0406

1. Using a torque wrench (PN: 01-201), connect the semi-rigid cable to the RF input of the MS27100A and to the input of the 2000-1894-R.
2. Connect the 3-67367 5-pin header connector to the input connector port of the 2000-1894-R.
3. Connect the 3-67367 USB-A connector to the MS27100A module USB-A port.

Chapter 3 — Setting Up Communication

3-1 Introduction

To communicate with the MS2710xA Remote Spectrum Monitoring system, or to change its IP configuration, a PC must be correctly set up to communicate with the instrument via a direct connection using a static IP. The sections in this guide explain using:

- A Windows PC to directly communicate with the Anritsu spectrum monitor
- SCPI commands for configuring the Ethernet and DNS settings
- The Anritsu Windows network discovery tool to find the instrument IP address

The spectrum monitor is shipped with the following default IP configuration:

- DHCP: OFF (Static IP Address)
- Static IP Address: 10.0.0.2
- Static Subnet: 255.255.255.0
- Static Gateway: 10.0.0.0

3-2 Setting Up Windows 7

The following example illustrates how to set up Windows 7 for a static IP address. Refer to your operating system documentation or consult with your network administrator for other Windows versions or operating systems.

Static IP

1. Connect an Ethernet crossover cable between a PC and the instrument.
2. Open Control Panel, Network. and Internet.
3. Select Network and Sharing Center.
4. Select the Local Area Connection link as shown in Figure 3-1.

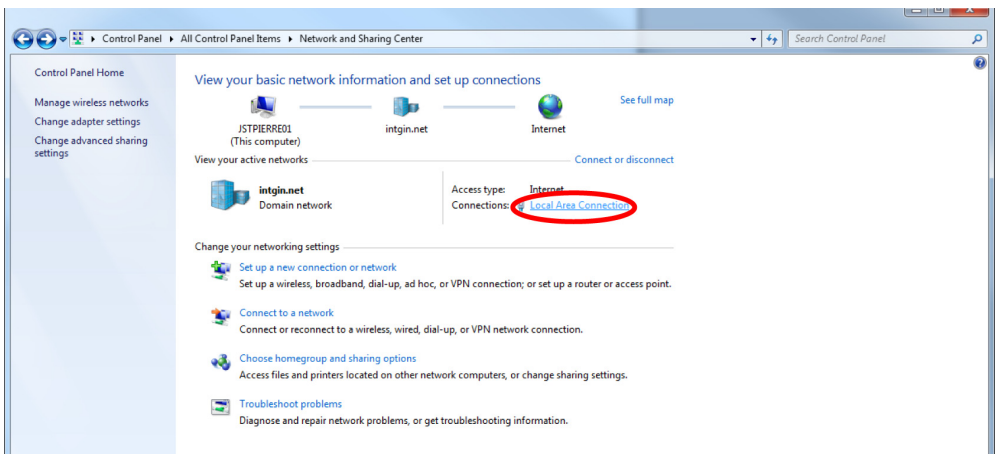
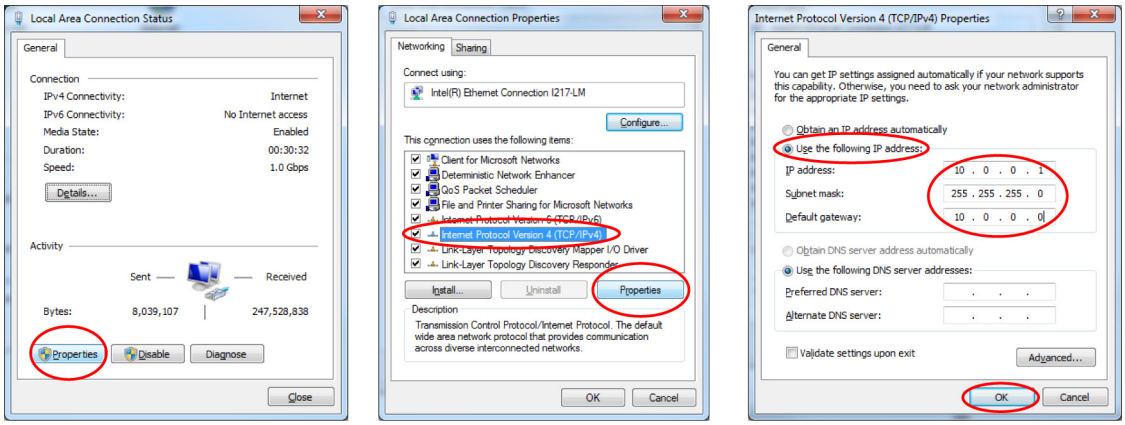


Figure 3-1. Local area connection link

5. Select Properties as shown in Figure 3-2, Step 1.
6. Highlight Internet Protocol Version 4 (TCP/IPv4) and select Properties as shown in Figure 3-2, Step 2.

7. Select Use the following IP address: and enter the following IP properties as shown in Figure 3-2, Step 3 as listed:
   - **Static IP Address:** 10.0.0.1
   - **Static Subnet:** 255.255.255.0
   - **Static Gateway:** 10.0.0.0



1. Local Area Connection Status Screen
2. Local Area Connection Properties Screen
3. Internet Protocol Version 4 (TCP/IPv4) Properties Screen

Figure 3-2. Windows configuration steps

8. To specify a domain name system (DNS) server, enter the preferred and alternate server addresses as shown in Figure 3-2, Step 3. You may need to contact your network administrator for details about using specific DNS servers; otherwise, select Obtain DNS server address automatically.
9. Click OK. The PC is now configured for a direct connection to the instrument using a static IP.

Dynamic IP

1. Select the Local Area Connection link as shown in Figure 3-3.

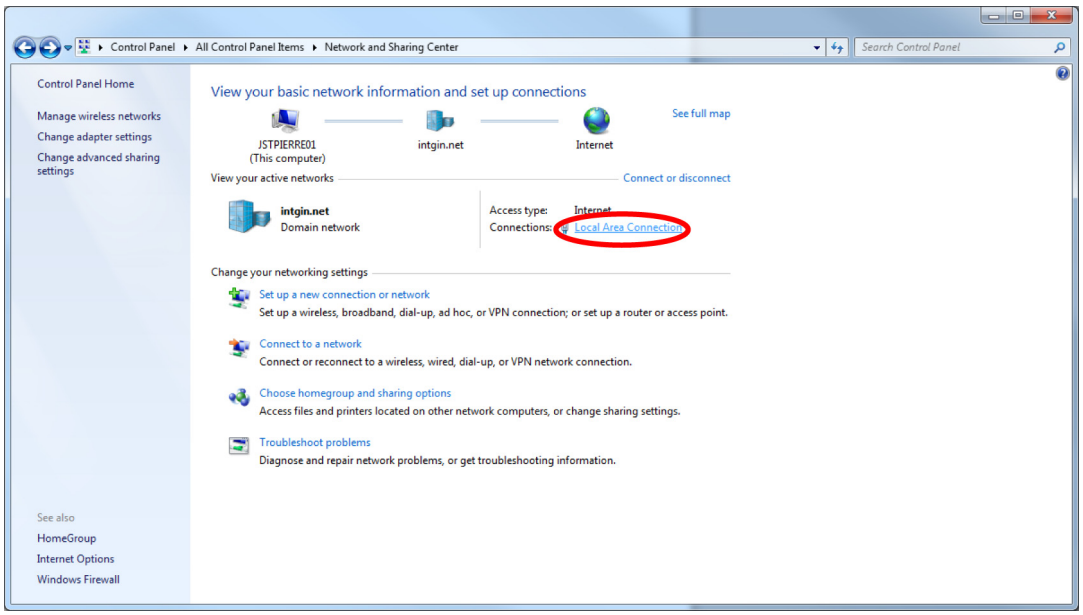
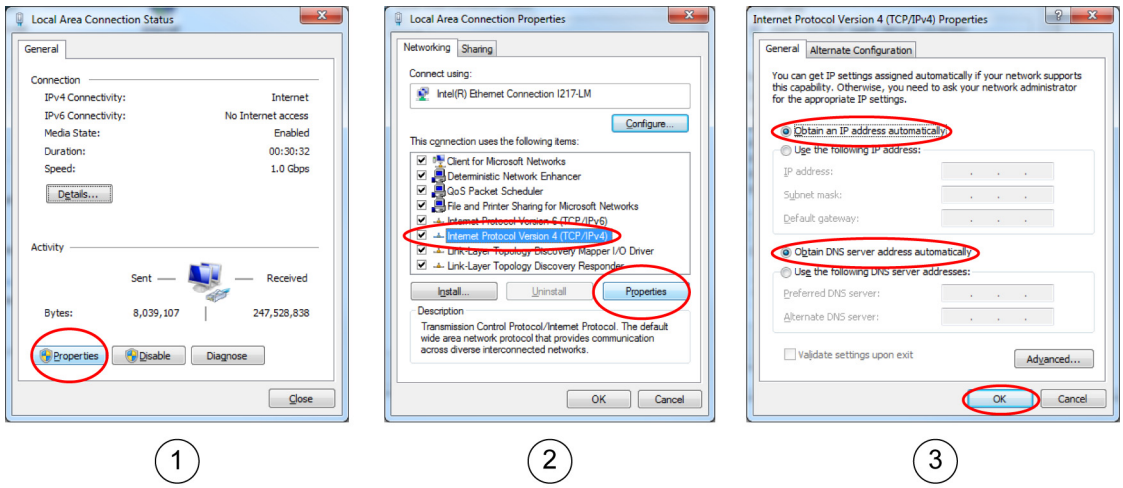


Figure 3-3. Select the Local Area Connection Link

2. Select Properties as shown in Figure 3-4, Step 1.
3. Highlight Internet Protocol Version 4 (TCP/IPv4) and select Properties as shown in Figure 3-4, Step 2.
4. Change the properties to match the illustration as shown in Figure 3-4, Step 3 as listed below:
   - Obtain an IP address automatically
   - Obtain DNS server address automatically



1. Local Area Connection Status Screen
2. Local Area Connection Properties Screen
3. Internet Protocol Version 4 (TCP/IPv4) Properties Screen

Figure 3-4. Windows configuration steps

3-3 UDP Discovery Tool

The UDP Discovery Tool is a Windows application that will display a sortable list of available MS2710xA devices on the network. This tool provides the ability to find and filter devices by Hostname, Model number, Serial number, MAC address, Version number, or by IP Address. If needed, the tool also provides the ability to save the results of your search and to view a brief history of your searches for comparison.

https://www.anritsu.com/en-US/test-measurement/support

During the download process, a screen will appear as shown in Figure 4.

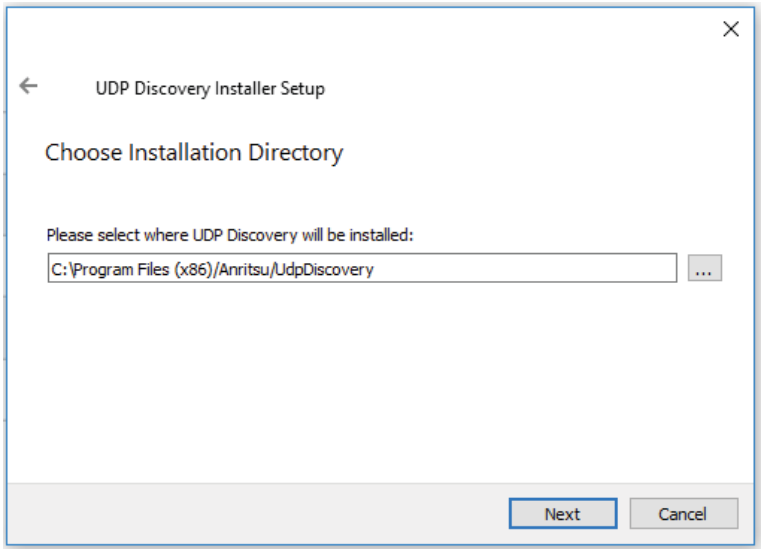
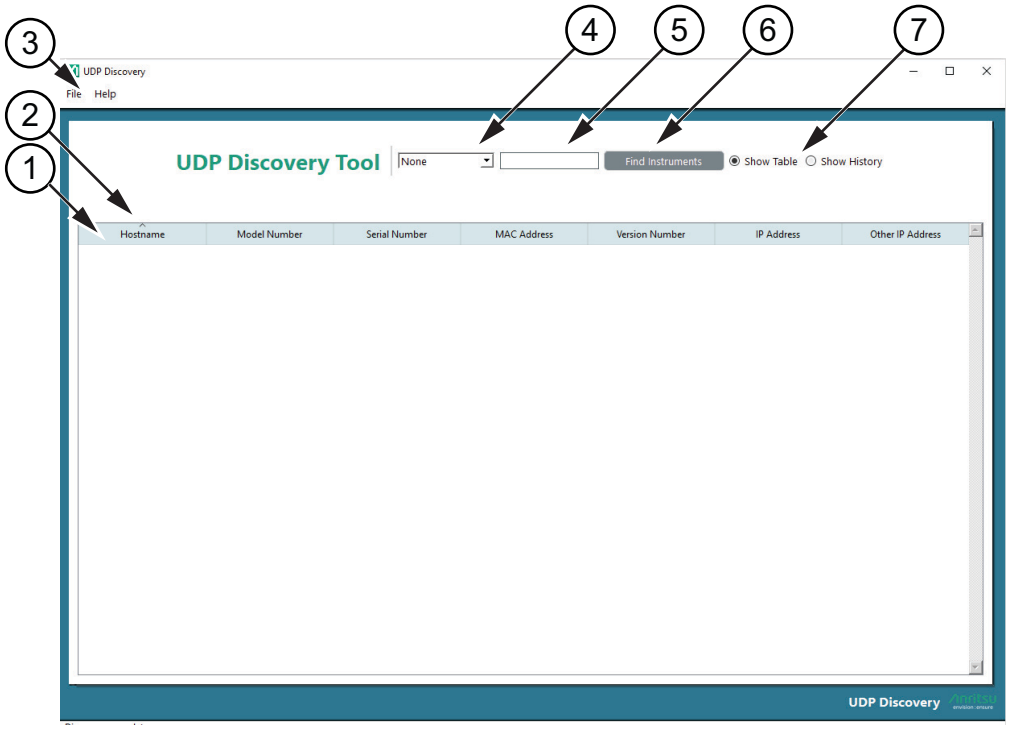


Figure 4. Installation Directory Default Location

When the download is complete, a user interface will appear as shown in Figure 5.



1. Column Header
2. Column Filter Caret
3. Toolbar
4. Selection Filter List
5. Filter Entry Field
6. Find Instruments Bar
7. Display Type

Figure 5. UDP Discovery Tool User Interface

Communicating with the RSM

There could be many instruments already connected to the network. Use the selection filter to narrow the search results.

Select a filter method

1. Click the connection arrow to display the filter list box are shown in Figure 6.

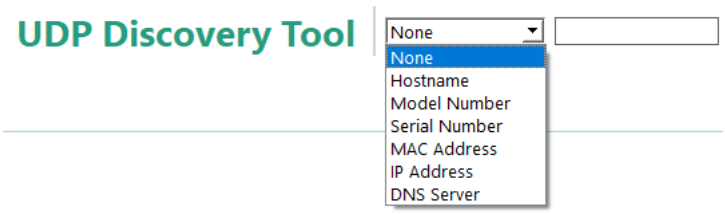


Figure 6. Filter List Box

2. Click a filter method from the list. The selections available are None, Hostname, Model Number, Serial Number, Mac Address, IP Address, IP Address, and DNS Server.

If a Hostname, Model Number, Serial Number, Mac Address, IP Address, IP Address, or DNS Server is not known, select None.

- None: All instruments attached to the local area network will be listed.
- Hostname: Host name of the probe
- Model Number: Model Number of the probe
- Serial Number: Serial Number of the probe
- MAC Address: Medium Access Control (MAC) address
- IP Address: Internet Protocol (IP) address
- DNS Server: Domain Name System (DNS) server

3. Click None to display an alphabetical listing of the inventoried instruments available to connect as shown in Figure 7.

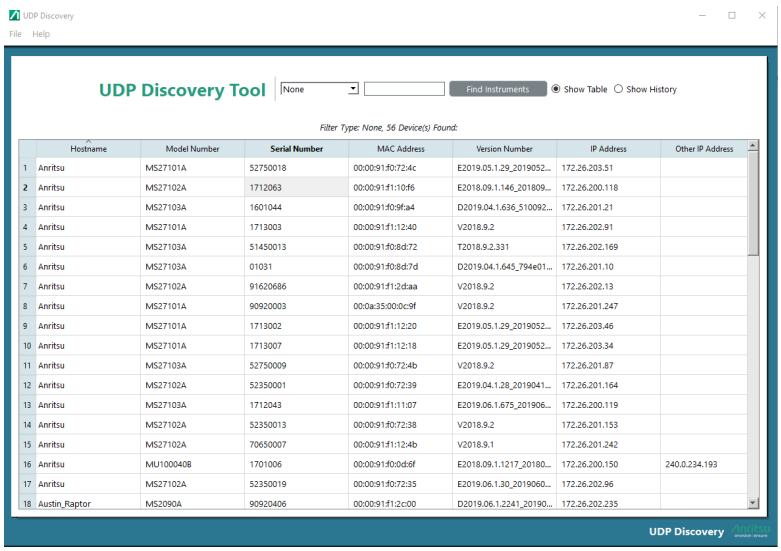


Figure 7. Displayed Instrument Inventory

Sorting the Listing

Selecting a column header displays a filter caret above column header as shown in Figure 5. When the caret is clicked, the listing is sorted by the column in the direction the caret is pointing. Clicking the caret again reverses the caret direction and sorts the listing in reverse order.

Copy and Paste Example

In this example, refer to the listing in Figure 7.

1. Click serial number 1713003.
2. Copy the serial number.
3. Paste the serial number in the box to the right of the filter list.
4. Click the Find Instruments bar. If the instrument is located, the instrument details will be displayed as shown in Figure 8.

A status readout is displayed above the column headings. In this example, the readout is:

Filter Type: Serial Number, Filter Value: 1713003, 1 Device(s) Found:

If the device could not be found, the last section would read: *No Device Found*

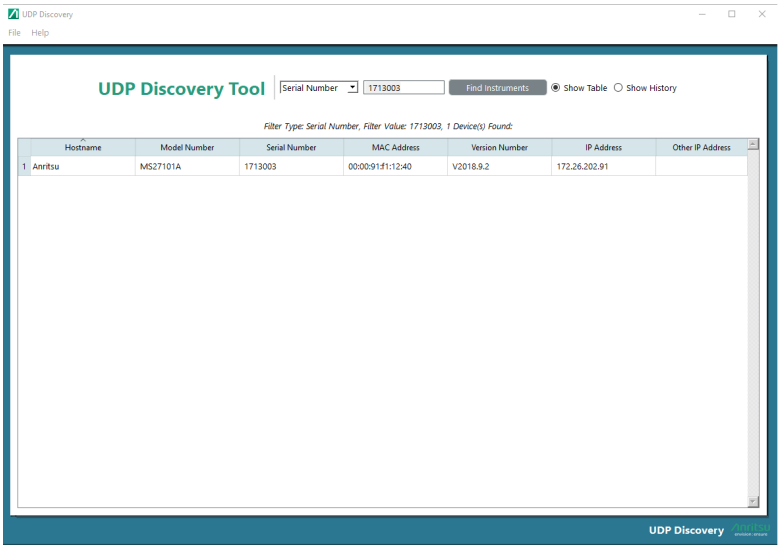


Figure 8. Locate Instrument

Connecting another device will erase the Show Table log and display the new device details. The previous erased device details will be available in the Show History log until the history details are erased. See"Clearing the History" on page 3-8.

User Interface Display Types

The selectable radio buttons provide the Show Table and Show History user interface connection display.

Show Table : Click this radio button to display the device connection details as shown in Figure 8.

Show History : Click this radio button to display current and previous connection-activity details as shown in Figure 9.

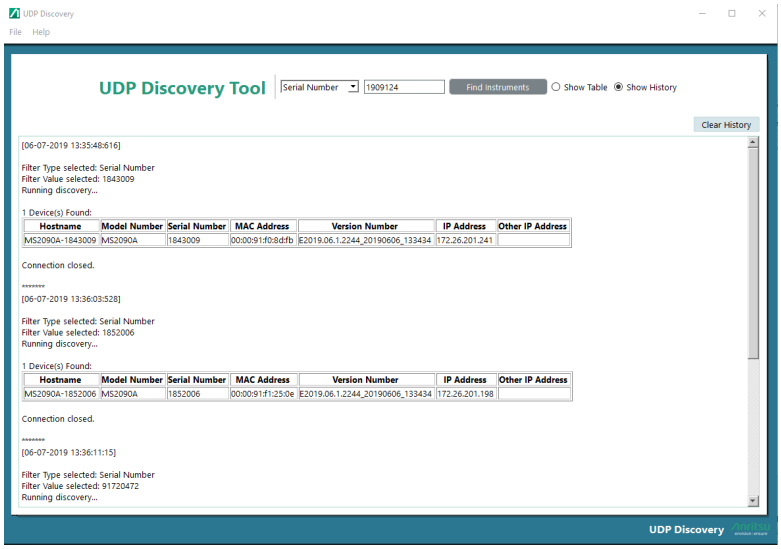


Figure 9. Show History

Clearing the History

Clear the Show History log by clicking the Clear History button or by clicking Clear Log from the Toolbar File menu.

1. Click Clear History will display the dialog shown in Figure 10.

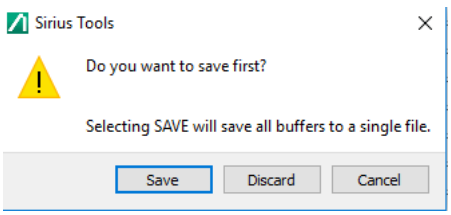


Figure 10. Clear History Dialog

   a. Click Save to save to a users selected location.
   b. Click Discard to remove the history contents without saving. The data will not be retrievable.
   c. Click Cancel to ignore the clear history request.

2. Click the File menu to display the menu as shown in Figure 11.

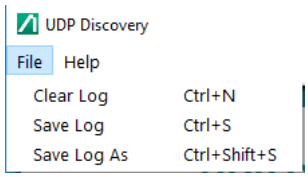


Figure 11. Clear History Using the File Menu

a. Click Clear Log to remove the History contents without saving. The data will not be retrievable.

b. Click Save Log to save to a users selected location. The location will be the same location selected from the Save Log As submenu.

c. Click Save Log As to save to a users selected location.

3-4 Configuring for Static IP through SCPI Commands

To change from DHCP to Static IP, send these commands to port 9001 of the instrument's dynamic IP address:

1. Set the static values of the Ethernet configuration that are used when DHCP is OFF:

   `SYSTem:COMMunicate:LAN:CONFig <Static IP>,<Static Gateway>, <Static Subnet>`

   The <Static IP>, <Static Gateway>, and <Static Subnet> must be enclosed in quotes like the following example:

   `SYST:COMM:LAN:CONF "124.168.1.1","124.168.1.0","255.255.255.0"`

2. Confirm the static IP settings by querying the static Ethernet configuration:

   `SYSTem:COMMunicate:LAN:CONFig?`

3. Turn off DHCP and set the instrument to static IP mode:

   `SYSTem:COMMunicate:LAN:DHCP OFF`

4. Reboot the instrument.

3-5 Using TCP_NODELAY

TCP_NODELAY is an option that client applications can set on the TCP socket they use to connect to the instrument's SCPI interface. This socket option disables Nagle's Algorithm, which is an optimization of the TCP/IP layer that causes small reads and writes to be buffered together, therefore reducing network bandwidth usage at the expense of increased latency. Application writers may see improved performance when setting TCP_NODELAY.

3-6 FTP Access

A FTP server has been included in the instrument to allow user access to files stored on the instrument or in a USB drive connected to the instrument. To access the FTP server, use a FTP client of choice and enter the IP address of the instrument as the host. The user name is "ftp" and the password is the serial number of the instrument. The serial number can be obtained through SCPI using the "*IDN?" command.

3-7 System Override

In the event that the instrument does not respond to SCPI commands (due to circumstances like a long sweep used in conjunction with `*OPC?`) and needs to be reset remotely, the system override feature can be used. System override can be accessed through TCP port 8001 of the instrument. All commands except a password reset will require the instrument's password to be sent. The default password for an instrument is the MAC address interleaved with the word "system" between MAC address pairs. As an example, an instrument with the MAC address "1a:2b:3c:4d:5e:6f" will have a default password of "1as2by3cs4dt5ee6fm". Currently, system override only supports three commands as described below:

1. Reboot the instrument:

   To reboot the instrument, send the following string to the instrument through port 8001:

   `"force_reboot,<instrument_password>"`

   Replace <instrument_password> with the password of the instrument. After the command has been sent, the instrument will respond with `"ok"` if the command has been successfully processed. If the password is incorrect, `"password_match_fail"` will be returned.

2. Set a new password:

   To set a new password for the instrument, the following string should be sent through port 8001:

   `"change_password,<old_instrument_password>,<new_instrument_password>"`

   Note that the max length of a password is 50 characters. If the new password has been successfully set, `"ok"` will be returned. If the password is too long, a `"password_over_50_characters_fail"` will be returned. If the old password does not match, a `"password_set_fail"` message will be returned.

3. Reset the password:

   In the case where the system override password needs to be reset to default, the following command can be sent through port 8001:

   `"reset_password"`

   Note that this command DOES NOT require the instrument password. If the password has been successfully reset, `"ok"` will be returned.

4. Disconnect SCPI connections:

   This command causes all currently established SCPI connections (on TCP port 9001) to be disconnected.

   reset_scpi_connection

   It can be used to immediately clean up connections that were left open due to network interruption (e.g. close handshake packets were dropped, client thinks it is disconnected but the instrument thinks the connection is still there) or to establish sole control of an instrument by forcing all other clients to reconnect. This command is automatically executed when secure mode is turned on.

If an improperly formatted command is sent to the instrument, a `"command_match_fail"` will be sent back.

To use dbutil:

1. Open a command window in Windows.
2. Enter the command:

dbutil /f ip_address where ip_address is the address of the RSM. Then the DNS name can be used instead of the ip_address.

3-8 Resetting a Blocked Port

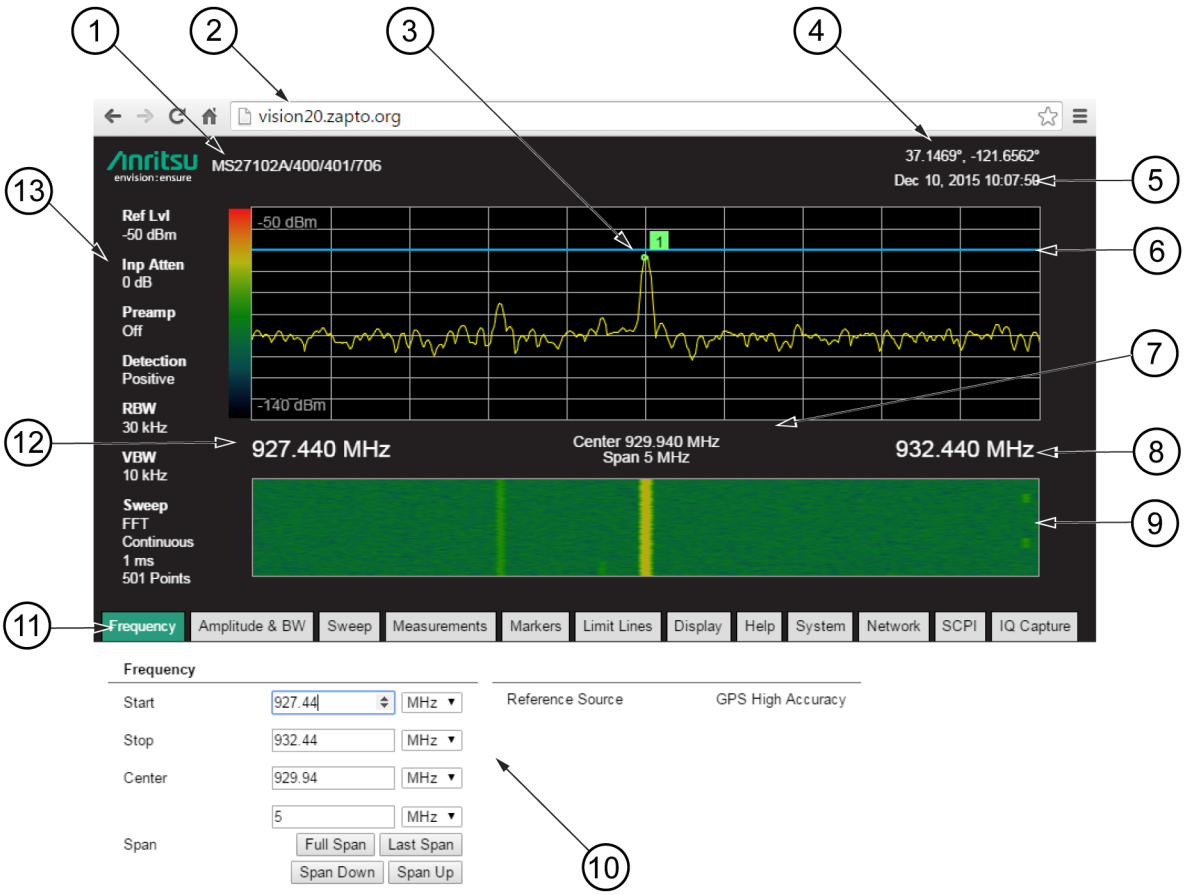
A port that is left open will prevent any communications with the RSM by another user. To reset an open port, use the database command line utility dbutil.exe to reset the port.

Chapter 4 — Graphical User Interface

4-1 Introduction

Each model of remote spectrum monitors contains an embedded web server. Using a browser (Google Chrome and Firefox are supported), users can access the graphical user interface (GUI) and send control commands to the remote spectrum monitor. Tabs and Setup Panels can change location in the web browser depending on the size of the browser.

The Graphical User Interface (GUI) measurement display provides manual measurements control and measured trace data. The Graphical User Interface (GUI) is shown below in Figure 4-1.



1. Model and Option Number(s)	8. Stop Frequency
2. Web/IP Address	9. Spectrogram
3. Marker	10. Setup Panel
4. GPS Coordinates	11. Setup Tabs
5. Date and Time	12. Start Frequency
6. Limit Line	13. Instrument Settings Summary
7. Center Frequency and Span	

Figure 4-1. Remote Spectrum Monitor GUI Overview

Model and Option Number(s) Web Address

Displays the model of the remote probe and the option(s) installed.

Web Address Model and Option Number(s)

The IP address of the Remote Spectrum Monitor entered into the Web Browser's address window.

Instrument Settings Summary

The Settings Summary lists the current settings for the reference level, input attenuation, RBW, VBW, sweep mode and type, and display points of the instrument.

Markers

Set up markers on the trace displayed. Eight markers are available for trace analysis.

GPS Coordinates

Displays the GPS coordinates of the measured signal.

Date and Time

Displays the date and time of the real time display.

Limit Line

Displays a limit line from the limit line setup panel.

Center Frequency and Span

Displays the Center Frequency and Span settings.

Stop Frequency

Displays the stop frequency of the displayed sweep.

Spectrogram

Spectrogram is a representation of the frequency spectrum as it varies with time.

Setup Panel

Displays the parameter entry fields of the selected Setup Tabs.

Setup Tabs

The setup tabs are described in Section 4-2 "Setup Tabs" on page 4-3.

Start Frequency

Displays the start frequency of the displayed sweep.

Instrument Settings Summary

Displays the default or selected settings that are entered into the Setup Tabs.

4-2 Setup Tabs

This row of tabs open up the panels for setting up measurement parameters, display, system and network configurations. The green tab denotes the open panel. Click on green tab or double-click on a gray tab to remove the setup panels from view and increase the display area. Click on any tab to return the setup panels into view.

Frequency Tab

Select the Frequency Tab to set up the start, stop, and center frequency of the trace displayed.

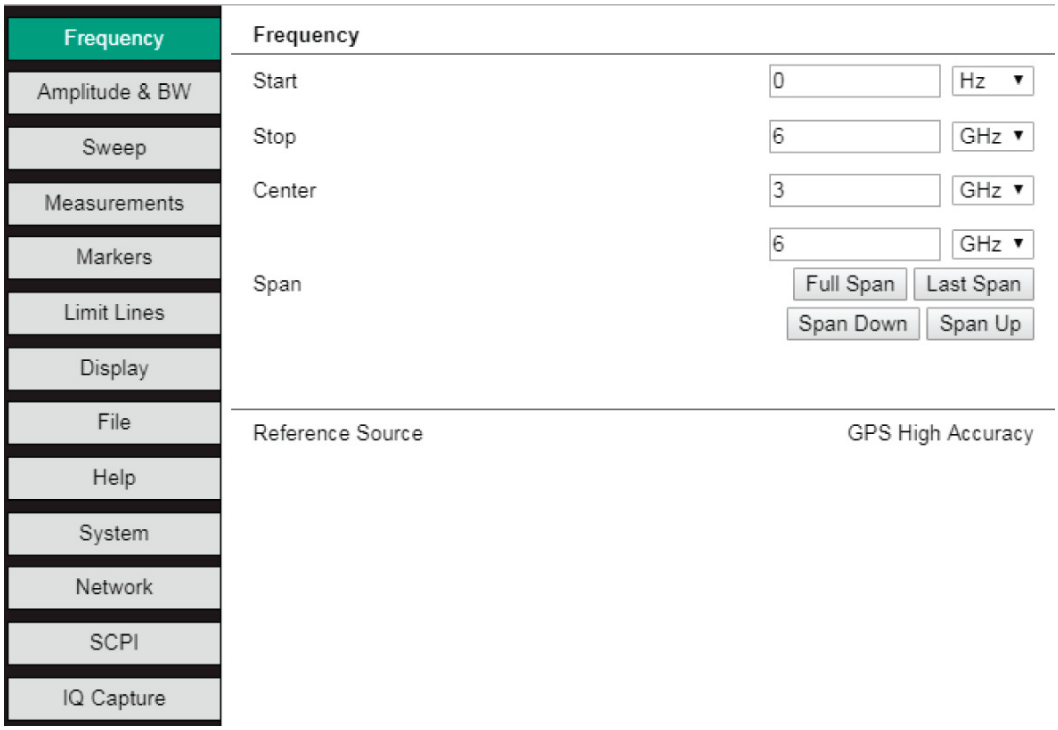


Figure 4-2. Frequency Tab

The frequency settings are displayed on the left and right bottom edges of the measurement display.

Using Start and Stop Frequencies

1. Enter the start frequency in the **Start** entry box.
2. Click the **Units** list associated with the start frequency entry box.
3. Select the desired Unit - Hz, kHz, MHz, or GHz. Typing the first letter of the units after typing the number will display the corresponding unit in the Units list box. For example, typing 700M automatically enters 700 MHz.
4. Enter the start frequency in the **Stop** entry box.
5. Click the **Units** list associated with the stop frequency entry box.
6. Select the desired Unit - Hz, kHz, MHz, or GHz.

Entering Center Frequency

1. Select the **Frequency** tab.
2. Enter the center frequency in the **Center** entry box.
3. Click the **Units** list associated with the start frequency entry box.
4. Select the desired Unit - Hz, kHz, MHz, or GHz.

Entering Span

1. Select the **Frequency** tab.
2. Enter the center frequency in the **Span** entry box.
3. Click the **Units** list associated with the start frequency entry box.
4. Select the desired Unit - Hz, kHz, MHz, or GHz.
5. There are also buttons for Full Span, Last Span, Span Down, and Span Up.
    - **Full Span**: Sets the span to cover the entire tunable spectrum of the instrument.
    - **Last Span**: Returns the span to the most recent span value immediately before a change was made.
    - **Span Down**: Span Down 1-2-5. This is a convenient way to narrow the frequency span. The first time this button is pressed, the span value decreases to the nearest even value that starts with 1, 2, or 5. For example, if the span is 1.8 MHz, then pressing this button for the first time changes the span to 1.0 MHz, and the next press takes the value to 500 kHz, then 200 kHz, and so on.
    - **Span Up**: Span Up 1-2-5. This is a convenient way to quickly arrive at a wider span value. The first time the button is pressed, the span value increases to the nearest even value that starts with 1, 2, or 5. For example, if the span is 1.8 MHz, then pressing this button for the first time changes the span to 2.0 MHz, and the next press takes the value to 5.0 MHz, and so on.

Amplitude and BW Tab

Select the Amplitude and BW tab to set the amplitude, bandwidth, and input parameters for measurement.

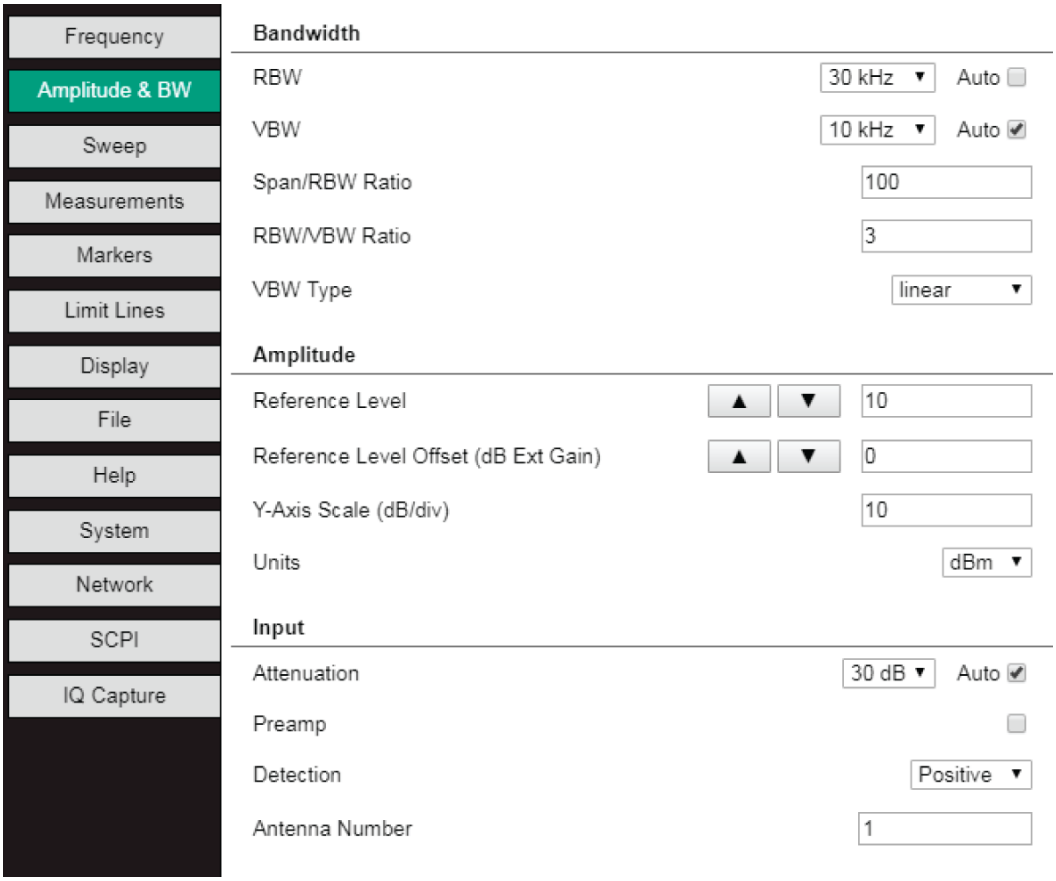


Figure 4-3. Amplitude and Bandwidth Tab

Setting the Bandwidth

1. Click the **RBW** list box. Select the desired RBW or check the box next to Auto to have the RBW set automatically.
2. Click the **VBW** list box. Select the desired VBW or check the box next to Auto to have the VBW set automatically.
3. Enter the desired Span/RBW ratio in the **Span/RBW Ratio** entry box.
4. Enter the desired RBW/VBW ratio in the **RBW/VBW Ratio** entry box.
5. Select the desired VBW type from the **VBW Type** drop-down list - linear or logarithmic.

Setting the Amplitude

1. Select the **Amplitude & BW** tab.
2. Enter a Reference Level value in the **Reference Level** entry box. Or, you can press the up/down arrow buttons to incrementally raise or lower the current value in the box.
3. Enter a Reference Level Offset (db Ext Gain) value in the **Reference Level Offset (db Ext Gain)** entry box. Or, you can press the up/down arrow buttons to incrementally increase or decrease the current value in the box.
4. Enter a Y-Axis scale value in the **Set the Y-Axis Scale (dB/div)** entry box.
5. From the **Units** drop-down list, select **dBm** or **dBuV**.

Setting the Input

1. Set the Attenuation by clicking on the list and selecting the desired attenuation value. Or, check the box next to **Auto** to have Attenuation set automatically.
2. Click the **Preamp** check box. If attenuation is set to Auto, then the Preamp can only be enabled for Reference Levels -40 dBm or lower.
3. Set the input detection by clicking the **Detection** list and selecting the desired state of detection - Positive, Negative or RMS.
4. Set the **Antenna Number** to the number of antenna ports on your instrument.

Sweep Tab

Select the Sweep tab to set Trace parameters and Sweep parameters.

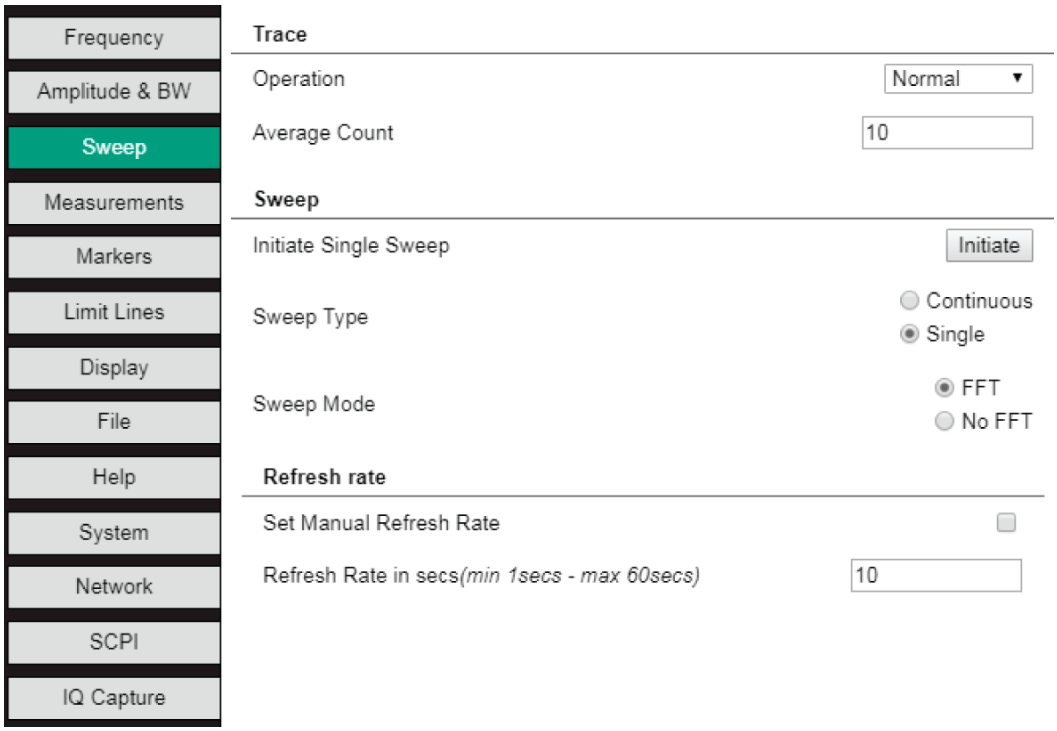


Figure 4-4. Sweep Tab

Trace

In trace average, the number of traces to average is specified in the Average Count box. The resulting trace then shows a moving average over X number of sweeps. For instance if the average count is set to "10", then trace average shows a moving average over 10 sweeps. The average is continuously updated as new sweep data is acquired.

Operation

- **Normal**: Displays data for the current trace sweep.
- **Min Hold**: Shows the cumulative minimum value of each display point over many trace sweeps.
- **Max Hold**: Shows the cumulative maximum value of each display point over many trace sweeps.
- **Average**: Shows an exponential average of a number of traces, determined by the number entered in Average Count.
- **Rolling Max**: Rolling max displays the max over a set number of sweeps. The number of sweeps is also specified in the average count box.
- **Rolling Min**: Rolling min displays the max over a set number of sweeps. The number of sweeps is also specified in the average count box.

Average Count

Sets the number of traces for use in calculating the average display value. The number used for averaging ranges from 1 to 65535.

Single/Continuous Sweep

In single sweep mode, after the sweep, the instrument waits in Hold mode until the **Initiate** button is pressed. Change the Sweep Type by selecting the radio button for Single or Continuous.

Sweep Modes

Two sweep modes are available on the instrument - FFT (default) or No FFT. Press the radio button for the desired Sweep Mode. Review the table below to help determine which mode to use for the current measurement.

Table 4-1. Sweep Modes Table

	FFT	No FFT
Sweep Speed	Fastest	Slowest
Capturing Short Burst	Better	Good
Amplitude Accuracy	Good	Specified
Spurious	Good	Best
FFT Artifacts	Small	None
Frequency Accuracy	Excellent	Excellent

Measurements Tab

Select the Measurements tab to do additional post-processing calculations on the spectrum data.

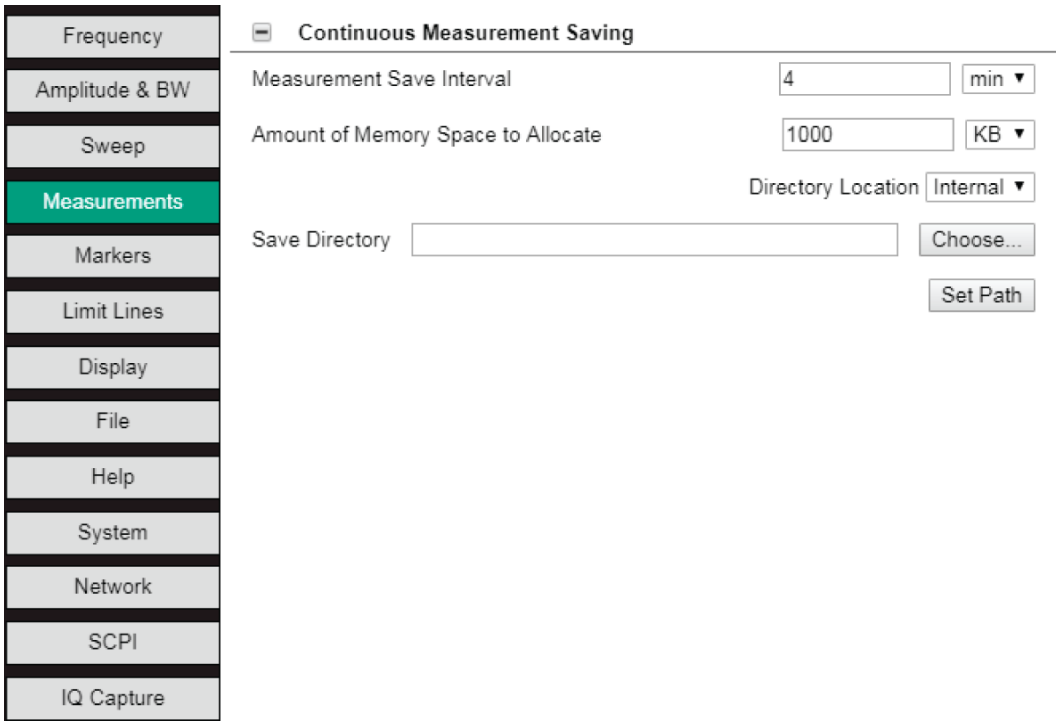


Figure 4-5. Measurements Tab

An Auto-Save function is available to save traces to Monitor Memory or to a USB stick. When initially run, the active measurement is spectrum.

Continuous Measurement Saving

This feature allows you to save measurements at the defined interval.

- **Measurement Save Interval:** This is the frequency that measurements are saved. If the interval is set to 5 minutes, it will save every 5 minutes.
- **Amount of Memory Space to Allocate:** Set the memory space allocation. This setting ensures that no more than the amount of space set is used to save measurements with this feature. If the value is 100 MB, once 100 MB have been allocated for measurement files, the next measurement save will cause the OLDEST measurement file saved to be deleted and the new one to be saved.
- **Directory Location:** Select **Internal** or **USB** if a USB memory device is available.
- **Save Directory:** Select **Choose** to enter or navigate to the location where the measurement files are to be saved.
- **Set Path:** Press when the Directory Location and Save Directory have been entered. Setting this path also sets the Save On Event path.

Markers Tab

Select the Markers tab to set up Markers Setup Panel.

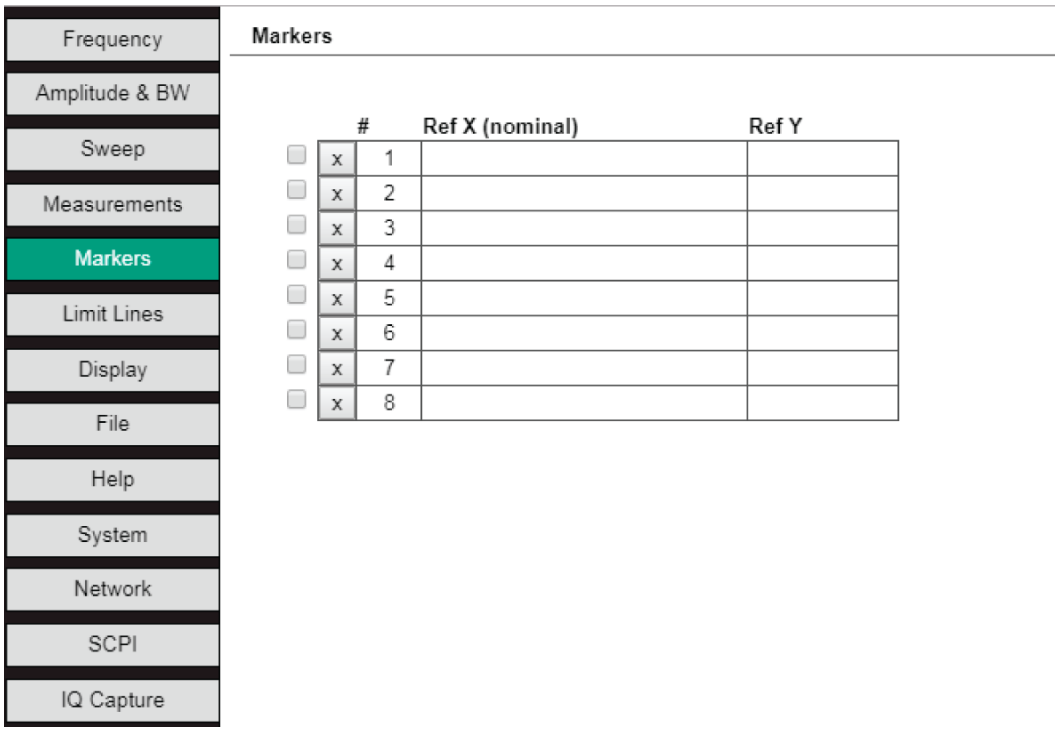


Figure 4-6. Markers Tab

1. Click the check box of the desired Marker.
2. Click on the **Ref X** entry box. Place the mouse cursor over the measurement display and a vertical line is drawn with its associated frequency and amplitude displayed in the Marker table.
3. Setting the frequency:
   - Type the desired frequency and units into the box.
   - Move the horizontal line cursor onto the trace at the desired point and click the left mouse button. The frequency value of that point is entered into the marker table. In the display, a red marker is created with it labeled 1, 2, 3, 4, 5, 6, 7, or 8.

   In either type of entry, the amplitude of the trace of the entered frequency will be automatically entered into the Amplitude box. If a frequency entry box is selected, the associated marker will be red. Markers with unselected frequency boxes are colored green. Deselect the marker/s by clicking on the desired check box.

Limit Lines Tab

Select the Limit Line tab to create and edit limit lines, limit masks and save on event functions.

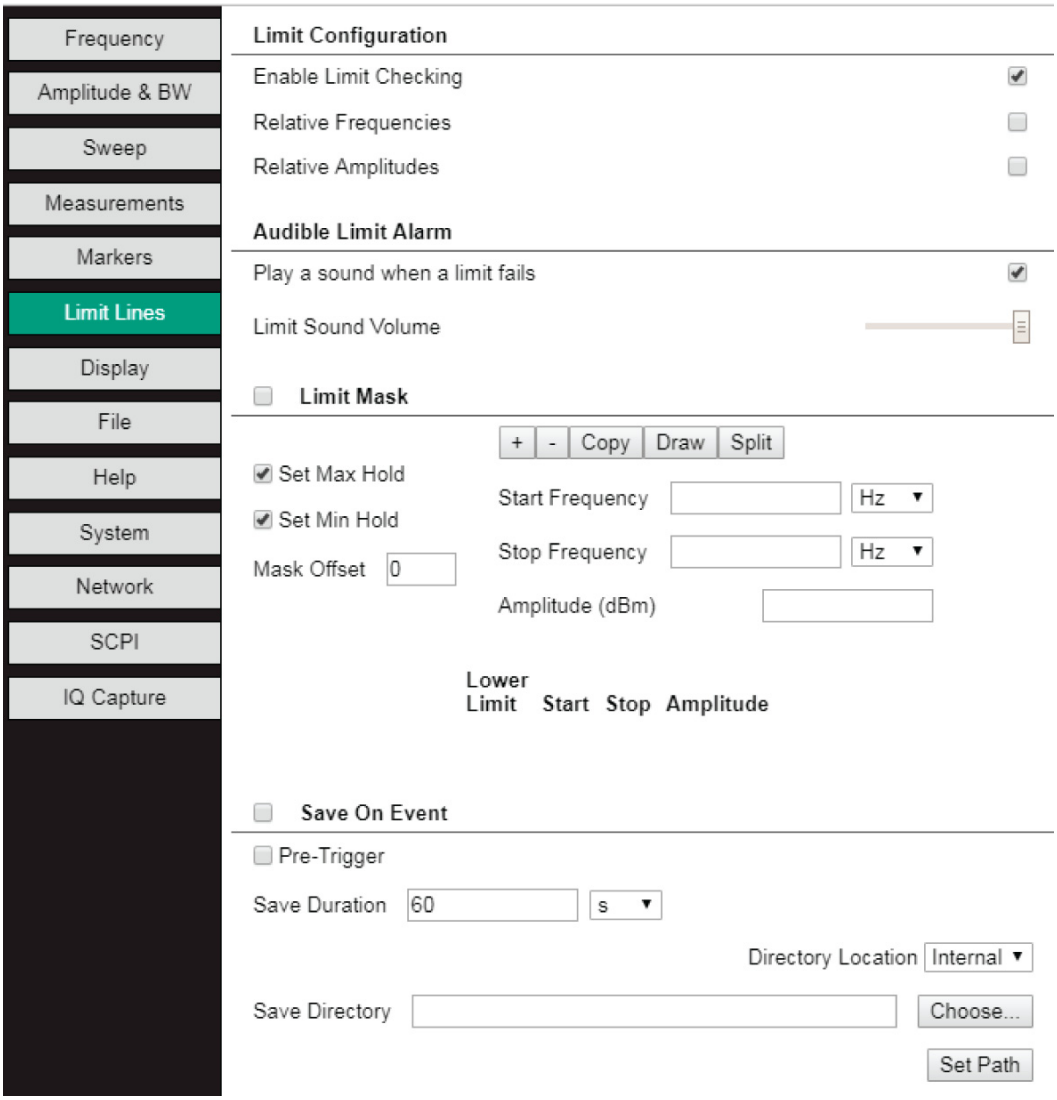


Figure 4-7. Limit Lines Tab

The Limit Line setup panel allows you to create upper and lower limit lines. An unlimited number of limit lines can be created. Limit lines are automatically entered into a table. The active editable limit line is green with larger end circles. The active line can be re-positioned on the measurement display. Place the cursor on the measurement display. Move the cursor and the limit line will move accordingly.

The limit lines shown in the display represent a 'limit being edited' and are not active on the instrument until Enable Limit Checking is checked. Also, editing a limit line will automatically enable limit checking. If Enable Limit Checking is unchecked and the user changes a limit, the box becomes checked.

To create a Limit Mask, click the check box left of the Limit Mask title. Multiple segments will be drawn above and below the trace.

A Limit Sound Volume can be adjusted.

Limit Configuration

- **Enable Limit Checking:** Click the check box to enable the limit checking feature. A red note will display when a signal amplitude crosses the limit line. If the feature "Play a sound when a limit fails" is checked, a beep will also occur.
- **Relative Frequencies:** Click to set the values of the start and stop frequencies relative to the center frequency.
- **Relative Amplitudes:** Click this check box to set the limit line amplitude relative to the top amplitude line value in the display.

Audible Limit Alarm

- **Play a sound when a limit fails:** When checked, a beep will occur when the limit line is violated.
- **Limit Sound Volume:** Move the control bar to adjust the volume sound level.

Limit Setup

- **Set Max Hold:** The signal that violates the upper threshold will trigger to save that trace.
- **Set Min Hold:** The signal that violates the lower threshold will trigger to save that trace.
- **Mask Offset:** Sets the a upper and lower mask distance from the trace. Set Mask Offset before clicking the Limit Mask checkbox.

Limit Segments & Mask Buttons

- **Add Limit Segment:** Press to automatically place a line in the center of the measurement display. The length of the line is 50% of the start and stop frequencies.
- **Delete Limit Row:** Highlight a limit line in the limit line table. The line will turn green. Press this button to remove it from the measurement display and limit line table.
- **Copy:** Replicates the active line. A the copied green line will be drawn over the original line. The original line will be colored blue. To get a quick view the new line, change its amplitude. Then drag it to the desired position.
- **Draw:** Turns the cursor into a pencil. Draws only one segment.
- **Split:** Halves the highlighted row/line into two segments.

Edit the frequency or amplitude value of the limit line by highlighting the limit line in the limit line table. Then change these values in their entry boxes. After a value has been entered, press the "check" button to use the value or press the "x" button to cancel the entry.

Save On Event

Limit alarm failures are reported whenever a signal is above the upper limit line or below the lower limit line. By using save-on-event, a signal that exceeds the limit alarm can be automatically saved. Click on Enable Limit Checking and Save On Event check boxes to activate Save On Event.

- **Pre-Trigger:** When checked, the trace before the failed trace and the failed trace will be saved.
- **Save Duration:** After a fail trigger has occurred, the program will save traces for the time entered. Enter a numerical value or use the up/down arrow buttons to increment/decrement to the desired value. Click the desired unit from the units drop-down list.
- **Directory Location:** Select **Internal** or **USB** if a USB memory device is available.
- **Save Directory:** Select **Choose** to enter or navigate to the location where the measurement files are to be saved.
- **Set Path:** Press when the Directory Location and Save Directory have been entered. Setting this path also sets the Continuous Measurement Saving path.

Note	Note: If a **Save On Event** is triggered, the next triggered event will take place only after the first event recording is complete.

Display Tab

Select the Display tab to set display resolution and correction.

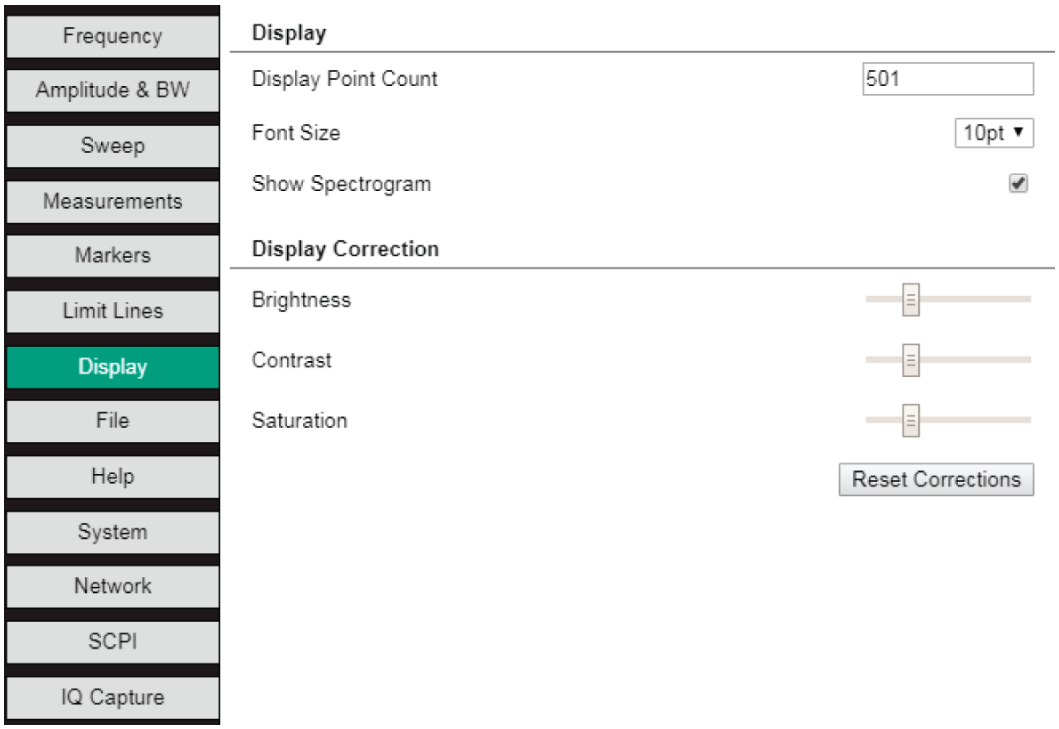


Figure 4-8. Display Tab

Set the Display Resolution

There are two types of display controls, display resolution and color management. There is also a check box to turn on/off the Spectrogram. To change the trace point count in the measurement display window and spectrogram, enter a value in the box labeled **Display Point Count**. Changing this value will have an inverse effect on sweep speed. An increase in the number of measurement points reduces the sweep speed while a decrease in points results in a faster sweep. Change the font size of the text in the measurement display, settings summary, tabs and setting panels by clicking on the pull-down list and selecting the desired font size. Click the check box for **Show Spectrogram** if you want the spectrum bar on the y-axis and spectrogram displayed.

Set the Display Correction

Adjust Brightness, Contrast, and Saturation by moving the their respective sliders. Press the **Reset Corrections** button to return the values to default.

File Tab

Select the File tab to manage the setup, measurement, limit line files using the Save, Copy, Recall, and Delete functions.

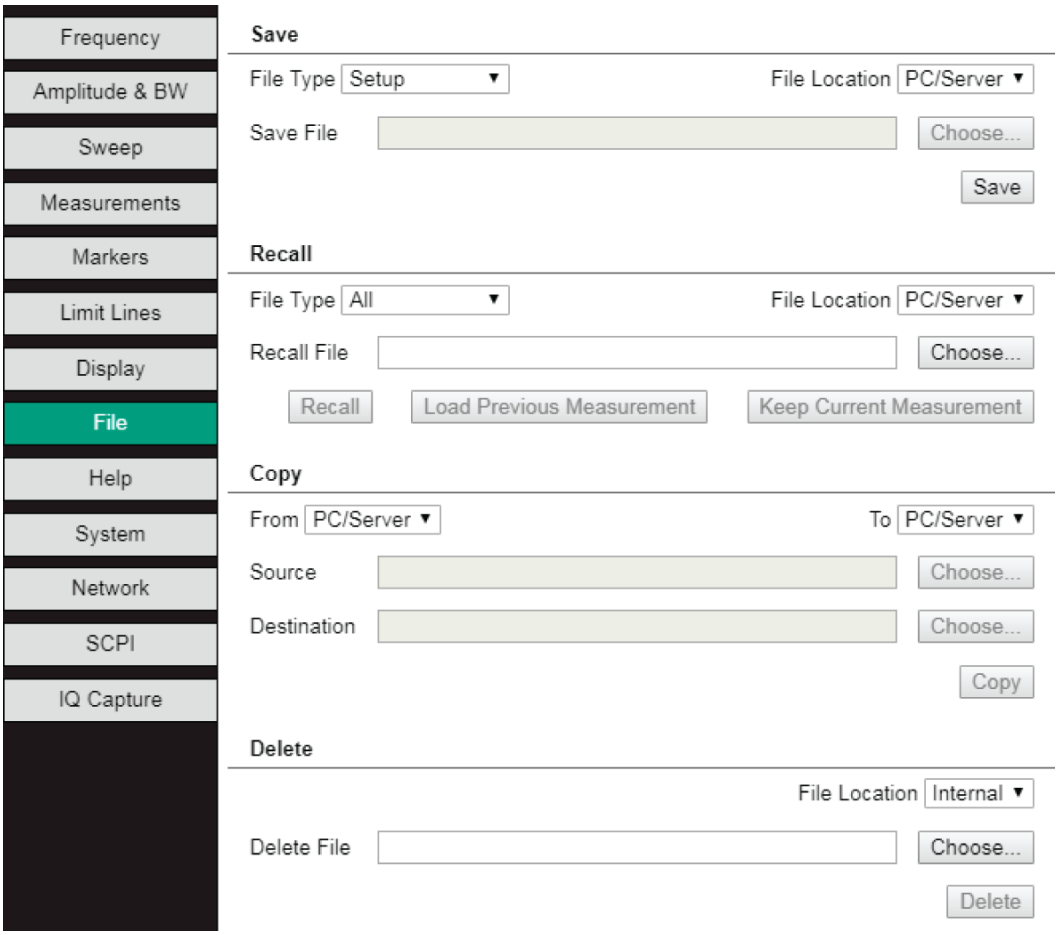


Figure 4-9. File Tab

For the Save, Recall, and Copy Functions there are selectable file types. File types vary with instrument modes. These file types are:

- **Setup:** Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.
- **Measurement:** Measurement files contain all of the information in the setup files and the measurement data.
- **Limit Lines:** The Limit Lines file contains limit line data details.
- **All:** Displays all file types.

Note	If the USB memory stick is removed from the instrument port during file navigation, the navigation widow will automatically close. If there are two USB memory sticks attached to the instrument, they will be listed as USB0 and USB1 on the drop-down list.

Save

1. Press the drop-down arrow for **File Type** to display the list of file types - Setup, Measurement, and Limit Lines.
2. Select the desired file type.
3. Press the drop-down arrow for **File Location** to select the destination location to save the file - PC/Server, Internal, or USB0.
4. Select the destination location. If PC/Server is selected, the Save File entry window will be grayed and inactive. The file will be placed in the Download folder of the PC when saved.
5. Press **Save**. The file is saved to the destination folder.

Copy

1. Press the drop-down arrow for **From** to select the source location of the file - PC/Server, Internal, or USB0.
2. Select the desired source location.
3. Press the drop-down arrow for **To** to select the destination location of the file - PC/Server, Internal, or USB0.
4. Select the destination folder. If PC/Server is selected, the Save File entry window will be grayed and inactive. The file will be placed in the Download folder of the PC when copied.
5. Press the **Choose** button for Source.
6. In the Source File dialog, navigate to the file and press **Choose**.
7. Press the **Choose** button for Destination.
8. In the Destination File dialog, navigate to the folder and press **Choose**.
9. Press **Copy**. The selected file is copied from the designated source folder to the designated destination folder.

Note	You cannot copy a file from PC/Server to PC/Server. The Source, Destination entry windows and the Copy button will be grayed and become inactive.

Recall

1. Press the drop-down arrow for **File Type** to display the file types - All, Setup, Measurement, Limit Lines.
2. Select the desired file type.
3. Press the drop-down arrow for **File Location** to select the source location for the file - PC/Server, Internal, or USB0.
4. Select the source location.
5. Press **Choose** for Recall File.
6. In the Recall File dialog, navigate to the desired file and press **Choose**.
7. Press **Recall**. The selected file is recalled.

After recalling a measurement, you can continue real-time measurements using the settings of the measurement just recalled or return to the measurement settings before the measurement recall was performed. Press either of the two buttons to select the desired real-time mode - Load Previous Measurement and Keep Current Measurement.

- **Load Previous Measurement:** Press this button to load the measurement settings that were in use before the Recall measurement process was executed. The unit returns to real-time measurements using those settings.
- **Keep Current Measurement:** The unit returns to real-time measurements using the settings from the "recalled measurement".

You can also return to the real-time measurement settings that were used before executing Recall measurement by clicking the **System Preset** button in the System panel.

Delete

1. Press the drop-down arrow for **File Location** to select the source location for the file - Internal or USB0.
2. Select the source location.
3. Press **Choose** for Delete File
4. Navigate to the desired file or folder in the Delete File Or Directory dialog and press **Choose**.
5. Press **Delete**. The file or folder will be deleted from source location.

Help Tab

Select the **Help** tab to view links to the Remote Spectrum Monitor Help file and SCPI Programming documents.

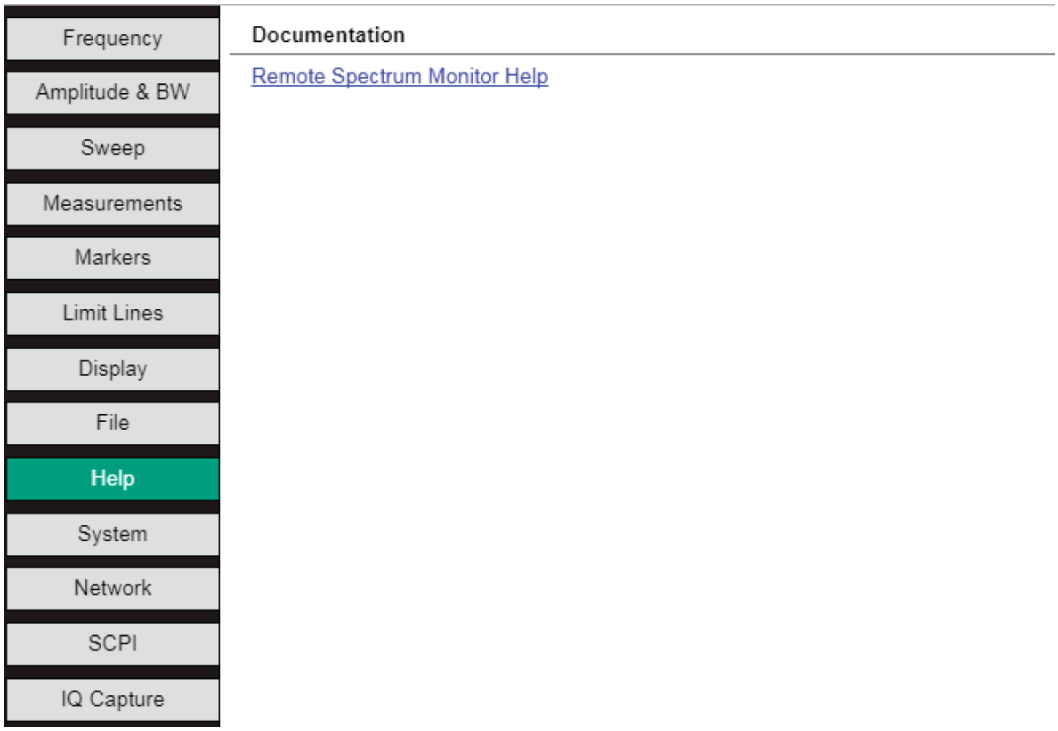


Figure 4-10. Help Tab

Configuring the System

Select the System tab to perform firmware updates, presets, other functions that affect the whole system, and view GPS information.

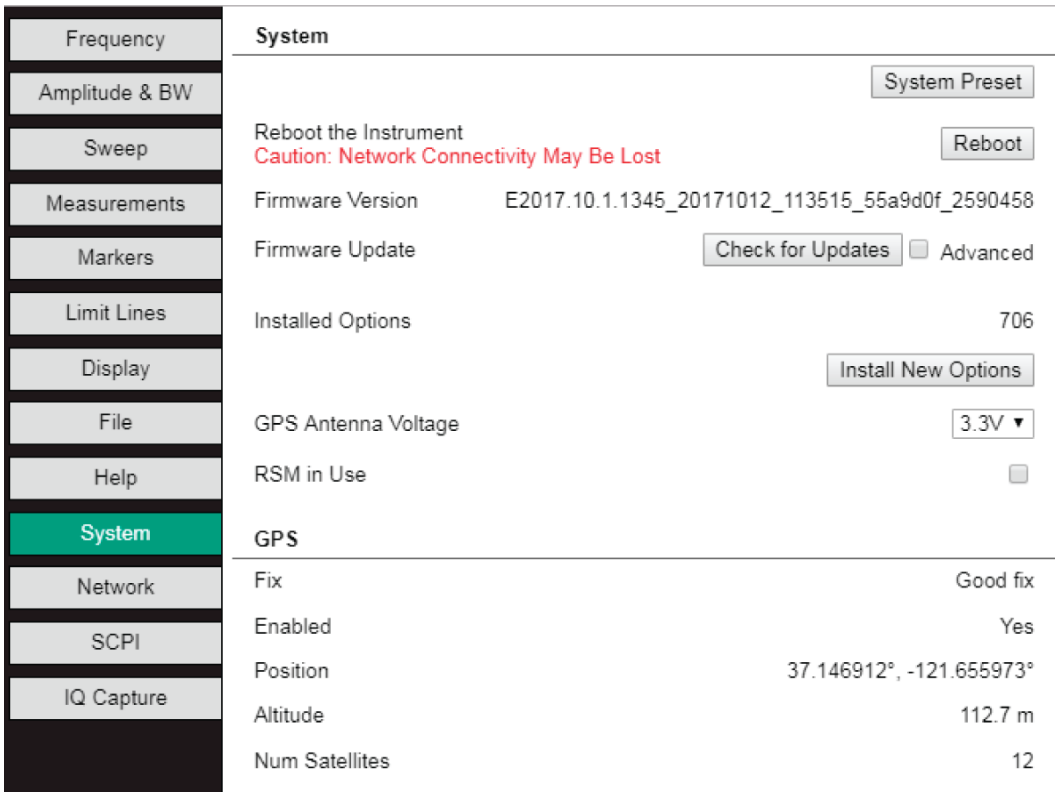


Figure 4-11. System Tab

The System section contains system information such as firmware version, installed options, Remote Spectrum Monitor GPS status, and RSM-in-use setting. Here the GPS supply voltage can be set to 3.3 V or 5 V.

When a System Preset is initiated the system is restored to factory default settings. See Table 4-2 Primary Factory Settings.

Table 4-2. Primary Factory Settings

Parameter	Value
Start Frequency	0 Hz
Stop Frequency	6 GHz
Center	3 GHz
Span	6 GHz
RBW	3 MHz
VBW	1 MHz
SPAN/RBW	100
RBW/VBW	3
VBW type	Linear
Reference Level	+10 dBm
Reference Level Offset	0 dB

Table 4-2. Primary Factory Settings

Parameter	Value
Y-Axis Scale	10 dB/div
Attenuation	30 dB
Preamp	Off
Detection	Positive
Antenna Number	1
Trace Operation	Normal
Sweep Type	Continuous
Sweep Mode	FFT
Display Point Count	501
Font Size	10 pt
Show Spectrogram	Yes
GPS Supply Voltage	3.3V

To return the instrument to its original default settings, press the **System Preset** button.

Power down and then power up the instrument using the **Reboot** button. (Network connectivity could be lost during this function. If the unit is configured for DHCP, then its IP address could also change after the reboot.)

Firmware Version and **Installed Options** display the current version of the firmware and the options included in the firmware.

Set the supply voltage for the GPS antenna in use by clicking on the **GPS Supply Voltage** list and selecting the desired voltage.

Press the **Check for Updates** button to check for recent releases of firmware. A simple check will be done by the software server to see what version of software is on the instrument. If the current firmware is up to date, you will be notified that it is. If not, a dialog will display and state that new firmware is available. Press the **Install Update** button to install the new firmware. The Advanced check box opens a firmware list - the current release, new firmware if available, and previously released versions of firmware. Select the desired firmware version and press the **Update to Selected** button.

For more information on Updating Firmware, refer to Appendix A, "Updating MS2710xA Firmware".

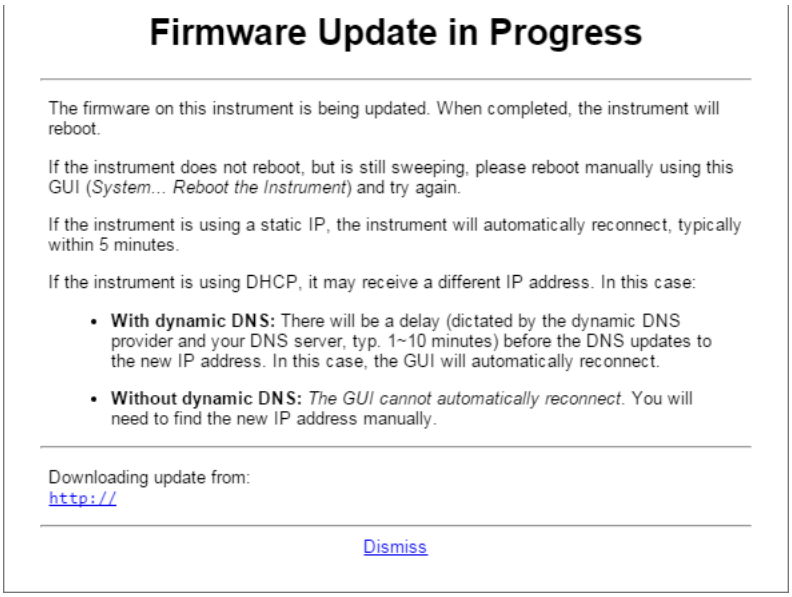


Figure 4-12. Firmware Update in Progress Dialog

To inform users that the RSM is in use, click the **RSM in Use** check box. Red text in browser will inform users that the RSM is in use.

Install New Options

To install new options, go into the **System** tab and select **Installing Options**. The **Installing Options** dialog will appear. See Figure 4-13.

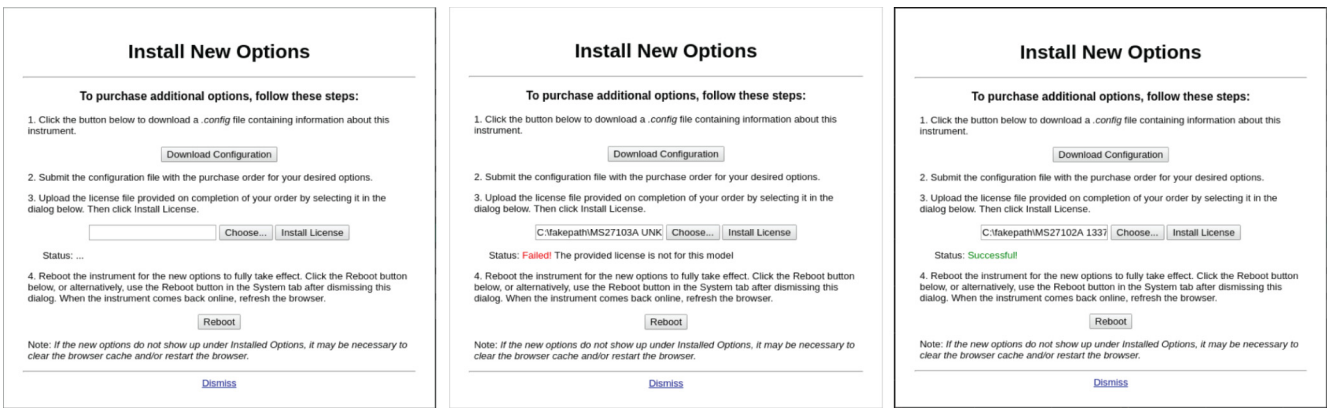


Figure 4-13. Install Options in Progress Dialog

Follow the instructions that appear in the dialog box. If the license installation was unsuccessful, a red **Failed!** message will appear in the **Status** field. If the license installation was successful, a green a **Successful!** message will appear in the **Status** field.

Continue with the option installation process by rebooting the instrument to activate the new options.

Network Tab

Select Network tab to configure and view the instrument's Ethernet and dynamic DNS settings.

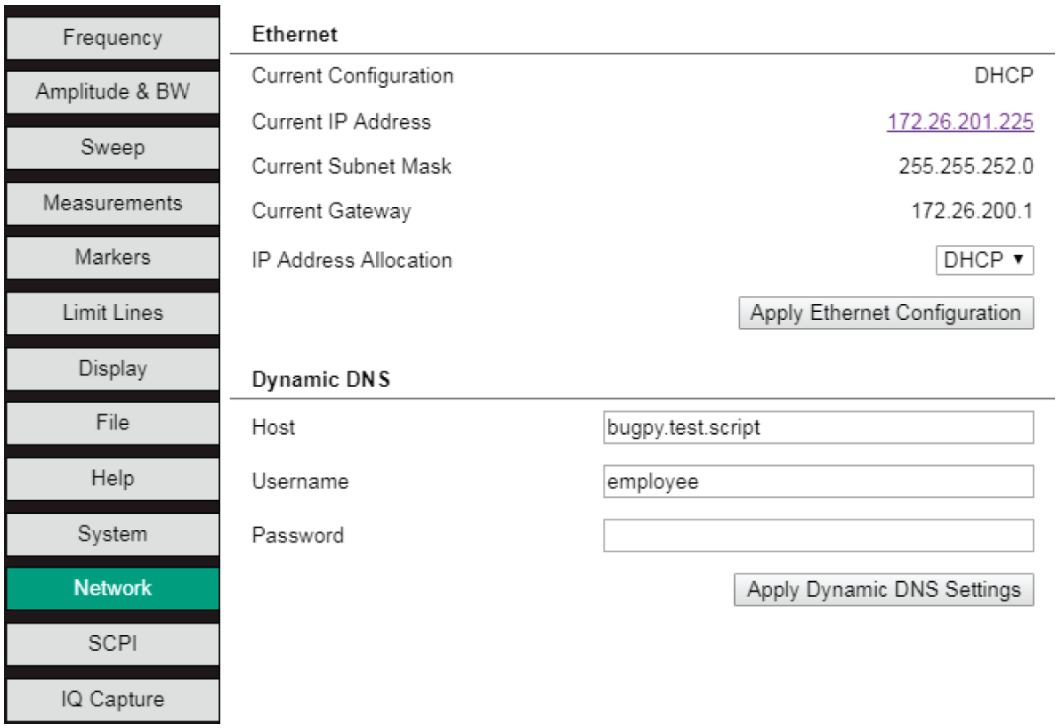


Figure 4-14. Network Tab

Ethernet

The Ethernet default is set to Static IP. The default Static IP is 10.0.0.2. To change static IP addresses, click on the **IP Address Allocation** list box in the Network tab and select Static. Three entry boxes will be listed - Static IP, Static Subnet and Static Gateway. Complete the requested information and then press the **Apply Ethernet Configuration** button.

To change to DHCP, click on the **IP Address Allocation** list box and select DHCP. Then press the **Apply Ethernet Configuration** button. This setting will automatically obtain an IP address from the DNS server. Refer to the Quick Start Guide to find the assigned DHCP IP address on your network.

Dynamic DNS

The information regarding Host, User name, and Password, should be obtained from the person setting up the network for remote spectrum monitoring. When the information is obtained and entered, press the **Apply Dynamic DNS Settings** button. Currently, only the www.no-ip.com Dynamic DNS service provider is supported.

GPS

The following are GPS information for the Remote Spectrum Monitor when GPS is enabled.

- **Fix:** States the quality of the last fixed GPS result.
- **Enabled:** Displays if the GPS function of the Remote Spectrum Monitor is enabled.
- **Position:** The latitude and longitude of the last fixed GPS result.
- **Altitude:** The altitude of the last fixed GPS result.
- **Num Satellites:** The number of satellites used in determining the location of the Remote Spectrum Monitor.

SCPI Tab

Select the SCPI Tab to open a console where users can directly type in SCPI commands and view the response of SCPI queries, or execute a sequence of commands contained in a text file.

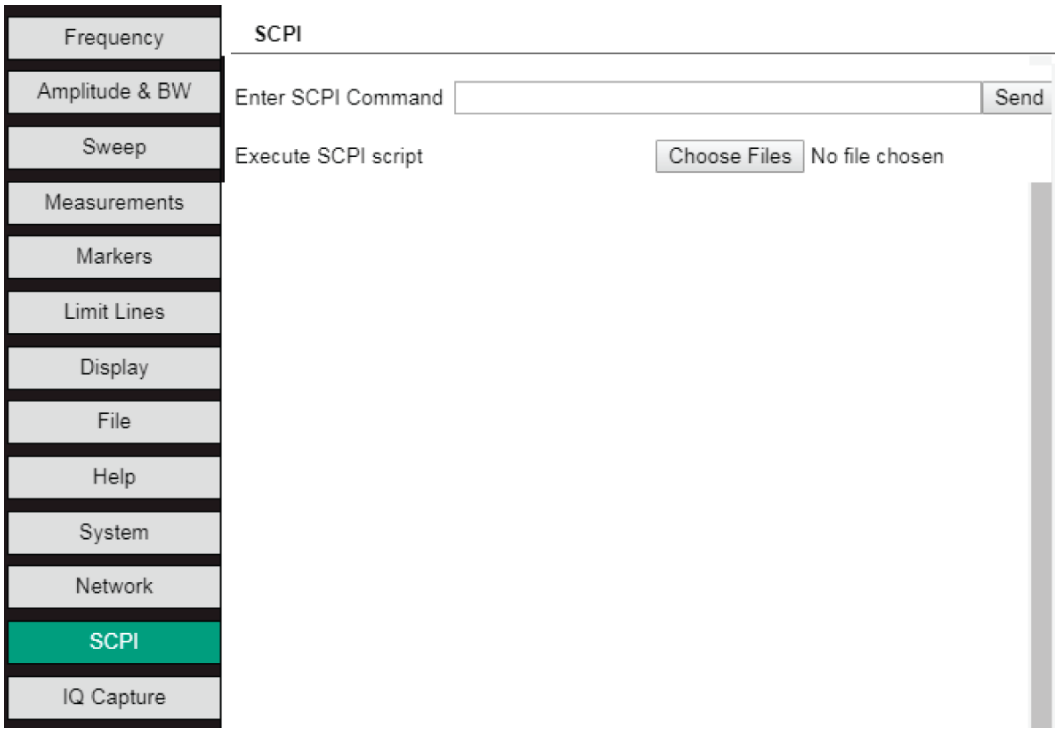


Figure 4-15. SCPI Tab

For example, you may want to add a custom name or label to identify a particular RSM unit, enter the command string SYST:UNIT:"name". The console also reflects any SCPI commands that were sent as a result of interacting with a control on a different tab. For more information refer to Chapter 5, "Programming with SCPI".

Execute a SCPI Command

1. Type a SCPI command in the **Enter SCPI Command** entry window.
2. Press **Send**. The SCPI command is executed and listed in the executed command list above.

Execute a SCPI Script

1. Press the **Choose Files** button.
2. Select the desired SCPI script from Open dialog window.
3. Press **Open** and the script is immediately executed.

Enter a Unit Name/Label

1. Type the SCPI command line - `SYST:UNIT:"name"`. The name/label desired is placed within the quotation marks.
2. Press **Send**. The unit name/label will be displayed on the application window under the model number.

IQ Capture

Select the IQ Capture tab to configure the parameters for IQ Capture and to view captured data in the Data Display.

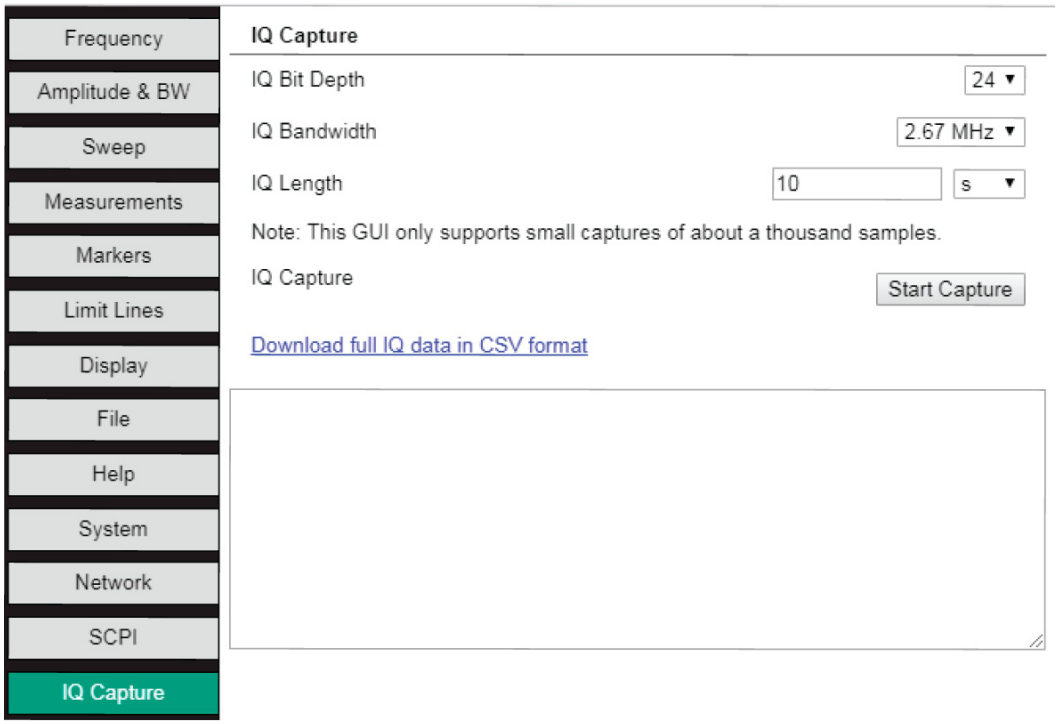


Figure 4-16. IQ Capture Tab

IQ Capture attains raw data, magnitude/phase or real/imaginary, components of a waveform. See Figure 4-17, "IQ Capture Measurement Sample". Configure the following IQ capture parameters and execute a capture.

IQ Bit

This sets the grid resolution for the display. Select the desired value from the pull-down list. The higher the number, the more positions the sample data (dots) can be in.

IQ Bandwidth

IQ Bandwidth is the rate of data to be collected for the duration of the IQ length. Select the desired value from the pull-down list.

IQ Length

This is the duration of the waveform capture. The GUI and data window can only display 1000 samples or data points. To view the additional data samples, click on the Download full IQ data in CSV format link to save the file. The maximum allowable capture period is 10 seconds.

Start Capture

Press this button to execute a capture.

Note	Confirm that the SCPI port is not in use. The SCPI port is used during IQ Capture because of the large amount of data being collected. A red notice will appear if the data capture is interrupted. "Resource unavailable. Is somebody using the SCPI Port?"

Vector Signal Analysis

IQ data can be captured for Vector Signal Analysis. The RSM must have Option 128 installed and non-formatted data can then be captured using the Anritsu MX280005A Vector Analysis Software to perform the modulation analysis. Formatted data captured with an RSM may not be supported by MX280005A. See the MX280005A User Guide (10580-00475) for a detailed description of the Vector Signal Analysis software operation and performance.

Download full IQ data in CSV format

Click this link to download all of the captured data into a CSV format file. The file is titled traceIqData.csv and saved to the Download folder.

Note	Information in the Instrument Setting Summary updates only after a capture has been completed.

Figure 4-17. IQ Capture Measurement Sample

4-3 Setting Secure Mode

Overview

Secure Mode prevents unauthorized access to both the setup parameters and measurement data stored on the monitor. The following sections detail the method and commands for securing a Remote Spectrum Monitor (RSM). Steps are listed to turn On or Off the Secure Mode for the desired remote spectrum monitor. Placing the RSM in secure mode requires a password. Users should determine that password before going through the setup. The default password is described in Setup Step 5. Communication to the RSM is done through port 8001. Port 8001 is always available whether Secure Mode is on or off.

A command is also provided to reset passwords to default. If this command is used, all setup parameters and measurement data stored on the RSM unit will be cleared. This ensures that unauthorized users will not have access to this information if they are able to gain physical access to the monitor. The secure mode will be off.

To communicate to the RSM unit, you must download **Anritsu RSM Secure Mode.zip** from the Anritsu website. This allows you to run the utility program, **Anritsu RSM Secure Mode.exe**, that communicates with the remote spectrum monitor.

Setup

Utility Program

1. Download from the Anritsu website **Anritsu RSM Secure Mode.zip**. Unzip the file onto the computer.
2. Insure you are connected to the remote spectrum monitor either via Ethernet or wireless. You will need to know either the monitor's IP address or DNS name.
3. Double-click **Anritsu RSM Secure Mode.exe** to run the utility script. Insure that all the unzipped files are in the same directory. The following command window opens.

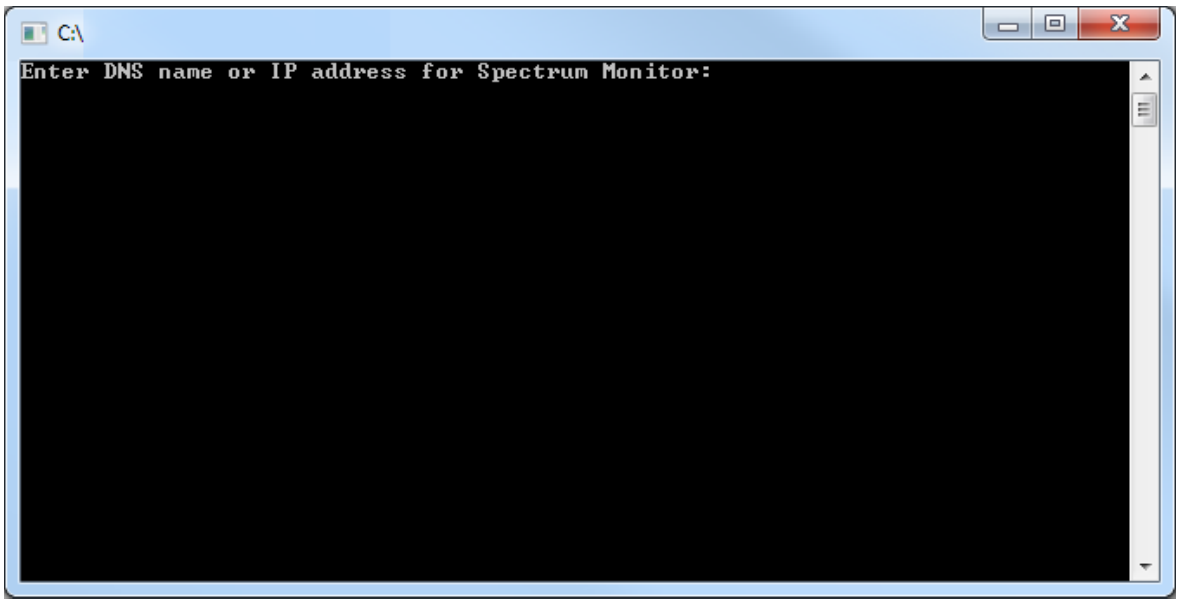


Figure 4-18. Command Window for Secure Mode

4. At the prompt, enter the DNS name or the IP address of the remote spectrum monitor.

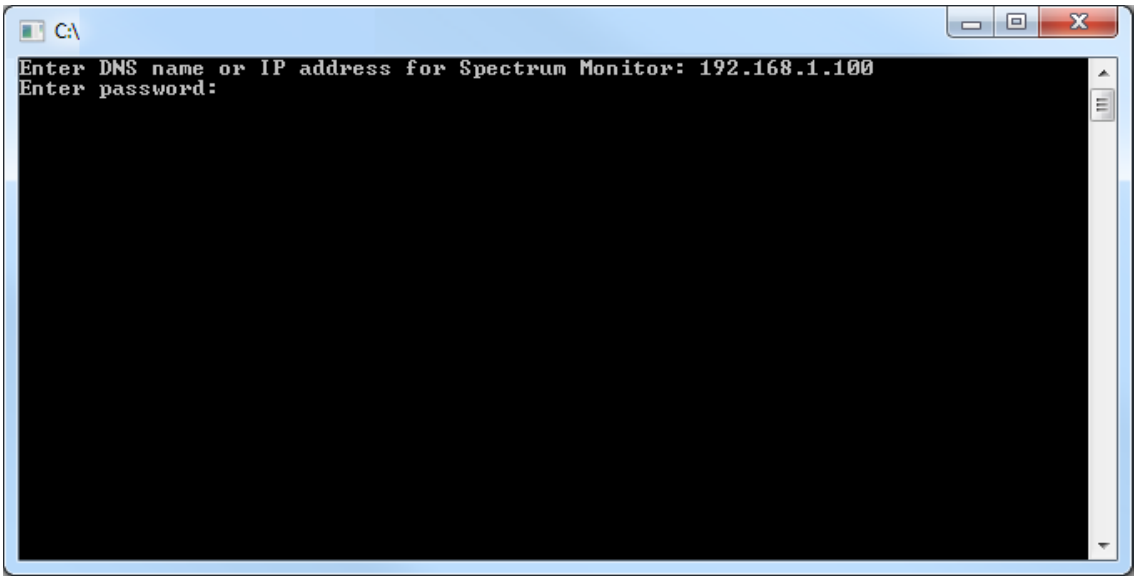


Figure 4-19. Command Window Waiting for Password

5. Enter the default password if setting up Secure Mode for the first time. The default password is a combination of the RSM MAC address and the word "system". For example, if the MAC address is 00:00:82:e1:63:40, the password is **00s00y82se1t63e40m**. Successfully entering the password will return the following response and Secure Mode commands shown in Figure 4-20. The MAC address can be found on a label on the RSM unit.

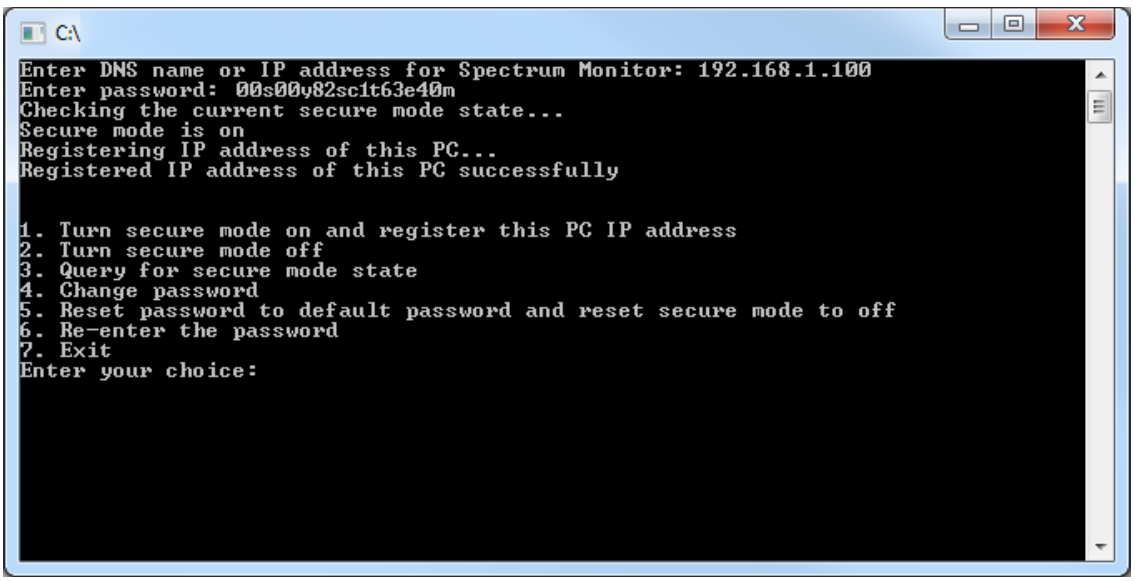


Figure 4-20. Command Window with the Default Password Entered

6. Enter the number of the desired command to execute the corresponding action.
7. To end the Secure Mode, enter **7** to exit the **Anritsu RSM Secure Mode.exe** utility program.

Commands

set_secure_mode,<system override password>,<on/off>

Description: Sets Secure Mode on or off. Responds with "ok" if secure mode has been successfully turned ON or OFF. If secure mode is OFF, sending "**on**" turns secure mode ON (blocking all users not on the whitelist from accessing any port except 8001) and adds the user to a whitelist. If secure mode is ON already and the user sends "on", the user is simply added to the whitelist. Sending "off" triggers a master reset and unblocks ports for all users. Responds with "password_match_fail" if provided System Override password is incorrect. Responds with "command_match_fail" if "on" or "off" is not sent.

The maximum number of registered clients is 100. Responds with "exceeded_max_secure_mode_users_fail" if max number of secure mode users have already been reached prior to the command being sent.

Parameters: <system override password>,<on or off>

Syntax Example: `set_secure_mode,<demopassword>,<on>`

force_reboot,<system override password>

Description: Reboots the remote spectrum analyzer. Responds with "ok" if command is accepted. A response of "password_match_fail" is returned if the provided System Override password is incorrect.

Parameters: <system override password>

Syntax Example: `force_reboot,<demopassword>`

change_password,<System Override Password>,<New Password>

Description: Changes the System Override Password. A response of "ok" if password has successfully been changed.

- "password_match_fail" is returned if the provided System Override password is incorrect.
- "command_match_fail" is returned if the new password is empty.
- "password_over_50_characters_fail" is returned if the password length is greater than 50 characters.

Parameters: <system override password>,<new password>

Syntax Example: `change_password,<demopassword>,<newdemopassword>`

reset_password

Description: Resets the System Override password back to the default value. A response of "ok" is returned when the password has successfully been reset.

Parameters: None

Syntax Example: `reset_password`

query_secure_mode_state

Description: Retrieves secure mode state, ON or OFF. A response of "on" is returned if secure mode is ON or "off" if secure mode is OFF.

Parameters: None

Syntax Example: `query_secure_mode_state`

Chapter 5 — Programming with SCPI

5-1 Introduction

This chapter provides an introduction to Standard Commands for Programming Instruments (SCPI) programming that includes descriptions of the command types, hierarchical command structure, command subsystems, data parameters, and notational conventions.

5-2 Remote Programming Setup and Interface

Remote programming and operation of the instrument is accomplished via the Ethernet. The following sections provide information about the interface connections, cable requirements, and remote operation setup.

Caution	Consult with your network administrator when configuring the network interface to avoid potential loss of access or discovery of the device.

Ethernet Interface Connection and Setup

The MS2710xA fully supports the IEEE-802.3 standard. Instrument functions (except power on/off) can be controlled via an Ethernet connection to a PC connected directly (with an Ethernet cross-over cable) or through a network. The instrument software supports the TCP/IP network protocol.

Ethernet networking uses a bus or star topology in which all of the interfacing devices are connected to a central cable called the bus, or are connected to a hub. Ethernet uses the CSMA/CD access method to handle simultaneous transmissions over the bus. CSMA/CD stands for *Carrier Sense Multiple Access/Collision Detection*. This standard enables network devices to detect simultaneous data channel usage, called a *collision*, and provides for a contention protocol. When a network device detects a collision, the CSMA/CD standard dictates that the data is retransmitted after waiting a random amount of time. If a second collision is detected, the data is again retransmitted after waiting twice as long. This is known as exponential back off.

The TCP/IP setup requires the following:

- IP Address: Every computer and electronic device in a TCP/IP network requires an IP address. An IP address has four numbers (each between 0 and 255) separated by periods. For example: 128.111.122.42 is a valid IP address.
- Subnet Mask: The subnet mask distinguishes the portion of the IP address that is the network ID from the portion that is the station ID. The subnet mask 255.255.0.0, when applied to the IP address given above, would identify the network ID as 128.111 and the station ID as 122.42. All stations in the same local area network should have the same network ID, but different station IDs.
- Default Gateway: A TCP/IP network can have a gateway to communicate beyond the LAN identified by the network ID. A gateway is a computer or electronic device that is connected to two different networks and can move TCP/IP data from one network to the other. A single LAN that is not connected to other LANs requires a default gateway setting of 0.0.0.0. If you have a gateway, then the default gateway would be set to the appropriate value of your gateway
- Ethernet Address: An Ethernet address is a unique 48-bit value that identifies a network interface card to the rest of the network. Every network card has a unique Ethernet address (MAC address) permanently stored into its memory.

Interface between the instrument and other devices on the network is via a category five (CAT-5) interface cable connected to a network. This cable uses four twisted pairs of insulated copper wires terminated into an RJ45 connector. CAT-5 cabling is capable of supporting frequencies up to 100 MHz and data transfer speeds up to 1 Gbps, which accommodates 1000Base-T, 100Base-T, and 10Base-T networks. CAT-5 cables are based on the EIA/TIA 568 Commercial Building Telecommunications Wiring Standard developed by the Electronics Industries Association.

LAN Connection

The RJ45 connector is used to connect the instrument to a local area network. The instrument IP address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address and subnet mask.

5-3 SCPI Common Commands

Some common commands are defined in the IEEE-488.2 standard and must be implemented by all SCPI compatible instruments. These commands are identified by the asterisk (*) at the beginning of the command keyword. These commands are defined to control instrument status registers, status reporting, synchronization, and other common functions. Examples of common commands supported by the instrument are shown below. See also Section 7-1 “System Common Commands”.

***IDN?**

Title: Identification Query

Description: This command returns the following information in <string> format separated by commas: manufacturer name (“Anritsu”), model number/options, serial number, firmware package number. The model number and options are separated by a “/” and each option is separated by a “/”.

For example, the return string might look like:
“Anritsu,MT8212E/3/2,62011032,1.23”

***RST**

Title: Reset

Description: This command reboots the instrument. Note that the instrument will power-cycle after this command is executed and the IP address might change if the Ethernet configuration is set to DHCP. After executing this command communication will be lost. Wait a minimum of 30 seconds before re-establishing communication.

Note	If the instrument does not operate correctly, this command can be used to restore the instrument to the original default settings and running condition.

SCPI Required Commands

The required SCPI commands supported by the instrument are listed below. These command work in all measurement modes.

Table 5-1. SCPI Required Commands

:STATus
:SYSTem

SCPI Optional Commands

Optional SCPI commands that comprise the majority of the command set are described in this document. These commands control most of the programmable functions of the instrument listed in the table below.

Table 5-2. SCPI Optional Commands

:ABORt	:FETCh	:MEASure	:SOURce
:CALCulate	:INITiate	:MMEMory	:TRACe
:CONFigure	:INPut	:READ	:UNIT
:DISPlay	:INSTrument	:ROUTe	[:SENSe]
:DIAGnostic			

The SCPI optional commands are sorted by measurement modes and commands may be repeated in more than one mode.

5-4 Subsystem Commands

Subsystem commands control all instrument functions and some general purpose functions. All subsystem commands are identified by the colon used between keywords, as in `:INITiate:CONTinuous`.

The following information is provided for each subsystem command described in the following chapters.

- The command name, see "Command Names" on page 5-4.
- The path from the subsystem root command, see "Hierarchical Command Structure" on page 5-5.
- The query form of the command (if applicable), see "Query Commands" on page 5-5.
- The command title.
- A description of the purpose of the command.
- The data parameters used as arguments for the command, see "Data Parameters" on page 5-7. This may include the parameter type and the available parameter choices.

Command Names

Typical SCPI commands consist of one or more keywords, parameters, and punctuation. SCPI command keywords can be a mixture of upper and lower case characters. Except for common commands, each keyword has a long and a short form. In this manual, the long form is presented with the short form in upper case and the remainder in lower case. For example, the long form of the command keyword to control the instrument display is `:DISPlay`.

The short form keyword is usually the first four characters of the long form (example: DISP for DISPlay). The exception to this is when the long form is longer than four characters and the fourth character is a vowel. In such cases, the vowel is dropped and the short form becomes the first three characters of the long form. Example: the short form of the keyword `:POWer` is `:POW`.

Some command keywords may have a numeric suffix to differentiate between multiple instrument features such as multiple trace options. For example; keywords `:TRACe[:DATA]{1|2|3}`, `:TRACe1`, or `:TRACe3`.

Note	In the previous paragraph, `:TRACe` is identical to `:TRACe1`. If a numeric suffix it not included in a command, the first option is implied. Curly brackets { } designate optional keyword parameters. Square brackets [ ] designate optional command keywords.

As with any programming language, the exact command keywords and command syntax must be used. The syntax of the individual commands is described in detail in the programming command chapters. Unrecognized versions of long form or short form commands, or improper syntax, will generate an error.

Long Format vs. Short Format

Each keyword has a long format and a short format. The start frequency can be specified by `:SENSe:FREQuency:STARt` or `:SENS:FREQ:STAR`. The capital letters in the command specification indicate the short form of the command. A mixture of the entire short form elements with entire long form elements of each command is acceptable. For example, `:SENS:FREQuency:STAR` is an acceptable form of the command. However, `:SENS:FREQuen:STA` is not an acceptable form of the command because `:FREQuen` is not the entire short or long form of the command element.

Hierarchical Command Structure

All SCPI commands, except the common commands, are organized in a hierarchical structure similar to the inverted tree file structure used in most computers. The SCPI standard refers to this structure as "the Command Tree." The command keywords that correspond to the major instrument control functions are located at the top of the command tree. The root command keywords for the SCPI command set are shown in Figure 5-1.

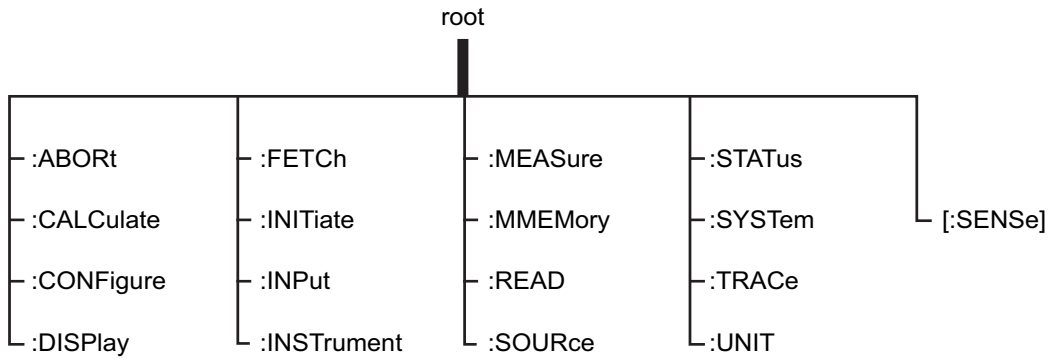


Figure 5-1. SCPI Command Tree

All instrument SCPI commands, except the `:ABORt` command, have one or more subcommands (keywords) associated with them to further define the instrument function to be controlled. The subcommand keywords may also have one or more associated subcommands (keywords). Each subcommand level adds another layer to the command tree. The command keyword and its associated subcommand keywords form a portion of the command tree called a command subsystem. A sample of the `:CONFigure` command subsystem is shown in Figure 5-2.

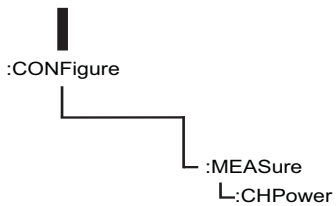


Figure 5-2. SCPI :Sample CONFigure Subsystem

A colon (:) separates each subsystem. For example, the command `:SENSe:FREQuency:STARt <freq>` sets the start frequency. The start frequency is part of the `:FREQuency` subsystem which is part of the `:SENSe subsystem`. Stop frequency is also part of the `:SENSe:FREQuency` subsystem. It is specified by `:SENSe:FREQuency:STOP`.

Query Commands

All commands, unless specifically noted in the commands syntax descriptions, have a query form. As defined in IEEE-488.2, a query is a command with a question mark symbol appended (examples: `*IDN?` and `:OPTions?`). When a query form of a command is received, the current setting associated with the command is placed in the output buffer. Query commands always return the short form of the parameter unless otherwise specified. Boolean values are returned as `1` or `0`, even when they can be set as `on` or `off`.

Identifiers

The following identifiers have been used throughout the optional command definitions. Descriptions are provided here. In most cases, units are specified with the individual command.

Table 5-3. Description of Command Indentifiers

Identifier	Description
<amplitude list>	Amplitude value. Units specified with the command.
<freq>	Frequency. Units specified with the command.
<integer>	Integer value, no units. Range specified with the command.
<number>	Numeric value, integer, or real.
<relative amplitude>	Relative amplitude. Units are always dB.

Data Parameters

Data parameters, referred to as "parameters," are the quantitative values used as arguments for the command keywords. The parameter type associated with a particular SCPI command is determined by the type of information required to control the particular instrument function. For example, Boolean (ON | OFF) type parameters are used with commands that control switch functions.

Some command descriptions specify the type of data parameter to be used with each command. The most commonly used parameter types are numeric, extended numeric, discrete, and Boolean.

Numeric

Numeric parameters comprise integer numbers or any number in decimal or scientific notation, and may include polarity signs. This includes <NR1>, <NR2>, and <NR3> numeric data as defined in "Data Parameter Notations" below. Parameters that accept all three <NR> formats are designated <NRf>.

Extended Numeric

Extended numeric parameters include values such as MAXimum and MINimum.

Discrete

Discrete parameters, such as INTernal and EXTernal, are used to control program settings to a predetermined finite value or condition.

Boolean

Boolean parameters represent binary conditions and may be expressed as ON, OFF or 1, 0.

Data Parameter Notations

The following syntax conventions are used for data parameter descriptions in this manual:

Table 5-4. Parameter Notations

<arg>	::=a generic command argument consisting of one or more of the other data types
<bNR1>	::=boolean values in <NR1> format; numeric 1 or 0
<boolean>	::=ON | OFF. Can also be represented as 1 or 0, where 1 means ON and 0 means OFF Boolean parameters are always returned as 1 or 0 in <NR1> format by query commands
<integer>	::=an unsigned integer without a decimal point (implied radix point)
<NR1>	::=a signed integer without a decimal point (implied radix point)
<NR2>	::=a signed number with an explicit radix point
<NR3>	::=a scaled explicit decimal point numeric value with and exponent (e.g., floating point number)
<NRf>	::=<NR1>|<NR2>|<NR3>
<nv>	::=SCPI numeric value: <NRf>|MINimum|MAXimum|UP|DOWN|DEFault|NAN (Not A Number)|INFinity|NINFinity (Negative Infinity) or other types
<char>	::=<CHARACTER PROGRAM DATA> Examples: CW, FIXed, UP, and DOWN
<string>	::=<STRING PROGRAM DATA> ASCII characters enclosed by double quotes. For example: "OFF"
<block>	::=IEEE-488.2 block data format
<NA>	::=Not Applicable

Note	+/- infinity and Not-A-Number (NAN) values can be specified for parameters of type NR3 with the values of +/- 9.9e37 and 9.91e37, respectively.

Unit Suffixes

Unit suffixes are not required for data parameters, provided the values are scaled for the global default units. The instrument SCPI default units are: Hz (Hertz) for frequency related parameters s (seconds) for time related parameters, and m (meters) for distance related parameters.

5-5 Notational Conventions

The SCPI interface standardizes command syntax and style that simplifies the task of programming across a wide range of instrumentation. As with any programming language, the exact command keywords and command syntax must be used. Unrecognized commands or improper syntax will not function.

Table 5-5. Notational Conventions

:	A colon links command keywords together to form commands. The colon is not an actual part of the keyword, but is a signal to the SCPI interface parser. A colon must precede a root keyword immediately following a semicolon (see “Notational Examples” on page 5-9).
;	A semicolon separates commands if multiple commands are placed on a single program line.
[ ]	Square brackets enclose one or more optional keywords.
{ }	Braces enclose one or more keyword or command parameters that may be included one or more times.
|	A vertical bar indicates “or” and is used to separate alternative parameter options. Example: ON | OFF is the same as ON or OFF.
< >	Angle brackets enclose parameter descriptions.
::=	Means “is defined as” For example: <a>::=<b><c> indicates that <b><c> can replace <a>.
sp	Space, referred to as *white space*, must be used to separate keywords from their associated data parameters. It must not be used between keywords or inside keywords.
XXX	Indicates a root command name

For further information about SCPI command syntax and style, refer to the Standard Commands for Programmable Instruments (SCPI) 1999.0 document.

5-6 Notational Examples

Table 5-6 provides examples of valid command Syntax

Table 5-6. Creating Valid Commands

Command Specification	Valid Forms

`[:SENSe]:FREQuency:STARt <freq>`	The following all produce the same result:
	`:SENSe:FREQuency:STARt 1 MHZ`
	`:SENS:FREQ:STAR 1 MHZ`
	`:sense:frequency:start 1000000`
	`:FREQ:STAR 1000 KHZ`

`:CALCulate:MARKer{1|2|3|4|5|6}:X <x-parameter>`	The first 2 commands set the location of marker 1. The third command sets the location of marker 2.
	`:CALC:MARK:X 1 GHZ`
	`:CALC:MARK1:X 1 GHZ`
	`:CALC:MARK2:X 2 GHZ`

`:UNIT:POWer DBM|DBV|DBMV|DBUV|V|W`	The following commands are identical:
	`:UNIT:POWer DBM`
	`:unit:pow dbm`

`:INITiate:CONTinuous OFF|ON|0|1`	The following commands are identical:
	`:INITiate:CONTinuous OFF`
	`:init:cont 0`

Command statements read from left to right and from top to bottom. In the command statement above, the `:FREQuency` keyword immediately follows the `:SENSe` keyword with no separating space. A space (*sp*) is used between the command string and its argument.

Note that the first keyword in the command string does not require a leading colon; however, it is good practice to always use a leading colon for all keywords. Note also that the `:SENSe` keyword is optional. This is a SCPI convention for all voltage or signal source type instruments that allows shorter command statements to be used.

The following is an example of a multiple command statement that uses two separate commands in a single statement:

```
:FREQuency:STARt 10E6;:FREQuency:STOP 20E9
```

Note	A semicolon is used to join the commands and a leading colon used immediately after the semicolon to start the second command.

Command Terminators

The <new line> character (ASCII 10) in the last data byte of a command string is used as a command terminator. Use of a command terminator will reset the command path to the root of the tree.

5-7 Formatting Conventions

This manual uses the following conventions in describing SCPI commands.

Table 5-7. Formatting Conventions

`:COMMands:LOOK:LIKE:THIS`	Commands are formatted to differentiate them from their description.
`:COMMand:QUERies:LOOK:LIKE:THIS?`	The query form of the command is followed by a “?”
`<identifier>`	Identifiers are enclosed in “< >”. They indicate that some type of data must be provided. See Table 5-3 for details on the types of identifiers.
`|`	The “|” indicates that a choice must be made.
`[optional input]`	Optional input is be enclosed in “[ ]”. The “[ ]” are not part of the command.

5-8 SCPI Command Programming Examples

This section provides information on spectrum trace data and I/Q data via SCPI commands.

Spectrum Trace Data via SCPI

SCPI commands are sent to port 9001 of the instrument. Below is a simple example to capture spectrum trace data.

```
SENS:FREQ:START 88 MHz
SENS:FREQ:STOP 108 MHz

//Set sweep mode
SWEEP:MODE FFT

//Set RBW 30 kHz
BANDWIDTH 30 KHz

//Set Reference Level to -30 dBm
DISP:WIND:TRAC:Y:SCAL:RLEV -30

//Set to single sweep
INIT:CONT OFF

//Get trace amplitude data
TRACE:DATA? 1

//Get number of display points to calculate frequency array
DISP:POIN?
```

Spectrum Trace Data Format

Trace data uses SCPI standard (IEEE 488.2) block data format. The data format is '#AXD', where D is a comma separated list of amplitudes (in ASCII), X is one or more ASCII digits specifying the number of bytes in D, and A is a single ASCII digit specifying the number of digits in X.

Trace data only contains amplitude. The frequency information for each point is

```
Frequency = [start_frequency + (span/(display_points-1))*N
N = 0, 1, … display_points
```

5-9 I/Q Capture Block Mode

This mode captures a single block of IQ data. I/Q data is first stored to high speed DDR2 SDRAM buffer memory and then it can be saved to flash memory or sent to a remote user via Ethernet. The capture length (duration) is limited by the size of the buffer memory (256 Mbytes) and I/Q data rate, which is determined by the capture bandwidth.

The IQ capture bandwidth must be set to one of the available values listed in the table below. For each selectable bandwidth, the output data rate for a single I/Q data pair is listed in Table 5-8. The output data rate does not change, regardless of bit resolution.

Table 5-8. IQ Capture Bandwidth Values

I/Q Bandwidth	Output Data Rate MSPS	IQ Sample Pairs/Sec
20 MHz	76.25 / 3	25416666.67
13.3 MHz	76.25 / 4	19062500
6.67 MHz	76.25 / 8	9531250
2.67 MHz	76.25 / 20	3812500
1.33 MHz	76.25 / 40	1906250
667 kHz	76.25 / 80	953125
267 kHz	76.25 / 200	381250
133 kHz	76.25 / 400	190625
66.7 kHz	76.25 / 800	95312.5
26.7 kHz	76.25 / 2000	38125
13.3 kHz	76.25 / 4000	19062.5
6.67 kHz	76.25 / 8000	9531.5
2.76 kHz	76.25 / 20000	3812.5
1.33 kHz	76.25 / 40000	1906.3

The maximum capture length is limited by memory, capture bandwidth and bit resolution. Table 5-9 on page 5-13 shows the maximum capture length.

Table 5-9. Maximum I/Q Block Capture Length

I/Q Band-width	24 bits	16 bits	10 bits	8 bits
20 MHz[a]	1.3 s	2.5 s	3.8 s	5.0 s
13.3 MHz	1.7 s	3.4 s	5.0 s	6.7 s
6.67 MHz	3.4 s	6.7 s	10.1 s	13.4 s
2.67 MHz	8.4 s	16.8 s	25.2 s	33.6 s
1.33 MHz	16.8 s	33.6 s	50.4 s	1.12 min
667 kHz	33.6 s	1.12 min	1.68 min	2.24 min
267 kHz	1.40 min	2.80 min	4.20 min	5.60 min
133 kHz	2.80 min	5.60 min	8.39 min	11.19 min
66.7 kHz	5.60 min	11.19 min	16.79 min	22.38 min
26.7 kHz	13.99 min	27.98 min	41.97 min	55.96 min
13.3 kHz	27.98 min	55.96 min	1.40 hr	1.87 hr
6.67 kHz	55.96 min	1.87 hr	2.80 hr	3.73 hr
2.67 kHz	2.33 hr	4.66 hr	6.99 hr	9.33 hr
1.33 kHz	4.66 hr	9.33 hr	13.99 hr	18.65 hr

a.For 20 MHz capture bandwidth, when IQ bit resolution is set to 32 bits, the lower 8 bits are zeros. Therefore the maximum effective bit resolution is 24 bits for 20 MHz bandwidth.

Raw Socket Connection

```
import socket
from time import sleep, time

class SocketConnection:
    """Provides a means to connect and send SCPI commands to the DUT using a
raw TCP socket."""
    def __init__(self, ipAddress):
        """
        Initializes an instance of SocketConnection class
        @param ipAddress The IP address of the device
        """

        # split out port number if given
        splitIpAddress = ipAddress.split(':')

        assert len(splitIpAddress) > 0
        assert len(splitIpAddress) <= 2
        self._ipAddress = splitIpAddress[0]

        #assign port
        if len(splitIpAddress) == 2:
            self._portNumber = int(splitIpAddress[1])
        else:
            self._portNumber = 9001

        self._socketConnection = None

        self._timeoutInSec = 120
        self._socketReadSize = 4096
        self.__nonBulkDataSizeCuttoff = 32768
        # Time to let the other end of the connection close
        self.__timeoutAfterCloseInSec = 1
        self._terminatedBlockResponse = False
        self.prefix = ''
        self._verbose = False

        self._establishConnection()

    def __del__(self):
        """
        This gets called by the garbage collector so it is possible that the
connection will
        remain open for a while before this gets collected.
        """
        self._closeConnection()
```

```
    def getpeername(self):
        return self._ipAddress, self._portNumber

    def settimeout(self, *args, **kwargs):
        return self._socketConnection.settimeout(*args, **kwargs)

    def expectTerminatedBlockResponse(self, newval=None):
        if newval is not None:
            self._terminatedBlockResponse = newval
        return self._terminatedBlockResponse

    def sendWriteCommand(self, scpiCommand):
        """
        Sends a SCPI write command.
        @param scpiCommand The SCPI command to send.
        """
        scpiCommand = self.prefix + scpiCommand
        try:
            returnValue = self._socketConnection.sendall(scpiCommand + "\n")
           assert returnValue is None, "Error sending command: " + scpiCommand
            if self._verbose:
                if len(scpiCommand) < self.__nonBulkDataSizeCuttoff:
                    print(scpiCommand + " sent successfully")
                else:
                    print( "sent long scpi command of length: " +
str(len(scpiCommand)))
        except socket.error as  msg:
          assert False, "Failed to send SCPI command: a socket error occurred
(Error code: " + str(msg[0]) + ", Error message: " + str(msg[1]) + ")"
        return

    def sendQueryCommand(self, scpiCommand):
        """
        Sends a SCPI query command and return the response.
        @param scpiCommand The SCPI query to send.
        @return The result of the SCPI command.
        """
        scpiCommand = self.prefix + scpiCommand
        try:
            returnValue = self._socketConnection.sendall(scpiCommand + "\n")
            assert returnValue is None, "failed to send command"
            if self._verbose:
                print(scpiCommand + " sent successfully")

            # Read 1 byte to check for a block data response header
            data = self._socketConnection.recv(1)
            assert len(data) > 0, "No data returned for query"
```

```
            if len(data) > 0 and data[0] == '#':
                # Block data response
                data = self._getBlockDataResponse()
            elif len(data) > 0 and data[0] == '\n':
                # Check for a response string that only contains a newline.
Remove the newline and return empty data.
                data = data[:-1]
            elif len(data) > 0:
                # ASCII response: receive until the entire response is read
                while True:
                    data += self._socketConnection.recv(self._socketReadSize)

                    assert len(data) < self.__nonBulkDataSizeCuttoff, \
                  "No newline character found in response to "  + scpiCommand
+ " SCPI command."

                    # Check for a new line at the end of the response
                    if data[-1] == '\n':
                        break;

                # Remove the trailing \n from the response
                data = data[:-1]
                if self._verbose:
                    print('Data received: "%s"' % data)

        except socket.error as msg:
           assert False, "Failed to send SCPI command: a socket error occurred
\n" + msg.__str__()
        return data

    def _establishConnection(self):
        """Establishes a connection. The call will fail if a connection is
already open."""
        assert self._socketConnection is None, "connection should not already
be open"
        try:
            self._socketConnection = socket.socket(socket.AF_INET,
socket.SOCK_STREAM)
            self._socketConnection.setsockopt(socket.SOL_SOCKET,
socket.SO_REUSEADDR, 1)
            self._socketConnection.settimeout(self._timeoutInSec)
            self._socketConnection.connect((self._ipAddress,
self._portNumber))
            self._socketConnection.setsockopt(socket.IPPROTO_TCP,
socket.TCP_NODELAY, 1)
        except socket.error as msg:
           assert False, "Failed to establish DUT connection (Error code: " +
```

```
str(msg[0]) + ", Error message: " + str(msg[1]) + ")"

    def _closeConnection(self):
        """
        Closes the socket connection and asserts that it closed. This informs
the other end of the
        socket that it should close but it may take some time depending on
implementation,
         network conditions, etc.
         """
        if self._socketConnection is not None:
            self._socketConnection.shutdown(socket.SHUT_RDWR)
            self._socketConnection.close()
            self._socketConnection = None
            sleep(self.__timeoutAfterCloseInSec)
        assert self._socketConnection is None, "Socket connection not closed"

    def _getBlockDataResponse(self):
        """
        Receives a SCPI block data response of the form 'AXD' where A is a
single ASCII byte
        specifying the number of digits in X, X is one or more ASCII bytes
specifying the number
        of bytes in D, and D is one or more bytes containing the response
binary data.
        """
        numSizeBytes = int(self._socketConnection.recv(1))

       assert numSizeBytes > 0, "The definite-length empty block response must
be #10 not #0."

        numDataBytesLeft = int(self._socketConnection.recv(numSizeBytes))
        responses = []
        readBuffer = bytearray(numDataBytesLeft)
        view = memoryview(readBuffer)

        timeoutSeconds = self._socketConnection.gettimeout()
        lastReadTime = time()

        while numDataBytesLeft > 0:
            numBytesRead = self._socketConnection.recv_into(view,
numDataBytesLeft)
            if numBytesRead > 0:
                lastReadTime = time()

            dt = time() - lastReadTime
            if dt > timeoutSeconds:
```

```
                raise Exception('Timeout after %d ms: Only read %d/%d bytes'
                                % (dt, len(readBuffer),
                                   len(readBuffer) + numDataBytesLeft))

            view = view[numBytesRead:]
            numDataBytesLeft = numDataBytesLeft - numBytesRead

        if self._terminatedBlockResponse:
            blockTerminator = self._socketConnection.recv(2)
            assert blockTerminator in ('\r\n', '\n')

        if self._verbose:
            print("Read bytes of block data: ", len(readBuffer))
        return readBuffer

    def reset(self, delay_seconds=-1):
        """
        Resets the established connection
        @param delay_seconds: Wait time between closing the connection and
attempting to
            re-establish the connection.  This is useful when rebooting an
instrument.
        """
        self._closeConnection()

        if delay_seconds >= 0:
            sleep(delay_seconds)
            try:
                self._establishConnection()
            except socket.error as msg:
               assert False, "Failed to establish DUT connection (Error code:
" + str(msg[0]) + ", Error message: " + str(msg[1]) + ")"
        else:
           reset_timeout = 300  # 300 seconds == 5 minutes == max polling time
            time.sleep(5)  # Fixed delay before attempting to reconnect
            while reset_timeout > 0:
                try:
                    self._socketConnection = socket.socket(socket.AF_INET,
socket.SOCK_STREAM)
                    self._socketConnection.setsockopt(socket.SOL_SOCKET,
socket.SO_REUSEADDR, 1)
                    self._socketConnection.settimeout(self._timeoutInSec)
                    self._socketConnection.connect((self._ipAddress,
self._portNumber))
                    break
                except Exception as msg :
                    self._socketConnection.close()
```

```
                    self._socketConnection = None
                    sleep(1)
                    reset_timeout -= 1
                    if reset_timeout <= 0:
                     assert False, "Failed to establish DUT connection (Error
code: " + str(msg[0]) + ", Error message: " + str(msg[1]) + ")"
```

I/Q Block Capture via SCPI

```
SENS:FREQ:CENTER 100 MHz
SENS:FREQ:SPAN 20 MHz
SWEEP:MODE FFT
//Set RBW 30 kHz
BANDWIDTH 30 KHz
//Set Reference Level to -30 dBm
DISP:WIND:TRAC:Y:SCAL:RLEV -30
//Set to single sweep
INIT:CONT OFF
//abort any sweep in progress
:ABORT


//Set Capture bandwidth. Not same as RBW.
IQ:BANDWIDTH 20 MHz


//Set 16 bit resolution
IQ:BITS 16


//Set to I/Q block capture mode
IQ:MODE SINGLE
//enable time stamp
SENS:IQ:TIME 1


//Set capture length to 5 msec
IQ:LENGTH 5 ms


//Start IQ Capture. Triggers single capture. Data is saved to DDR2 SDRAM memory.
MEAS:IQ:CAPT


//Check if capture is completed normally
STATus:OPERation?


//The STATus:OPERation? query responds with a integer. Convert this integer to binary.
//Bit 9 is set to 1 when the MEAS:IQ:CAPT command is issued.
//Bit 9 is set to 0 when the capture is completed normally in block mode.
```

IQ Capture Data to Absolute Power Level

This is a sample Matlab/Octave program that shows how Raw IQ capture data can be related to an Absolute power level.

```
%Copy data into captureData array
%Separate the data and build the complex IQ vector.
%First column contains Q and the second I
quadphase   = captureData(:,1);
inphase = captureData(:,2);
IQData = (inphase+1i*quadphase);
%Send SCPI Command [:SENSe]:iQ:SAMPle:CALibration:CONFiguration?
%and get absolute reference offset
absolute_ref_offset = -2.007958;
fs = 13.3e6;%Sampling frequency
n = 1024; %number of samples
%Perform fft
y = abs(fft(IQData, n));
y = fftshift(y);
%Scale fft output
y = y/n;
%To power
y = 20 * log10(y);
%To Absolute power level
y = y + absolute_ref_offset;
%Peak Value
peak = max(y);
f = fs*(-n/2:n/2-1)/n;
plot(f, y);
xlabel("Frequency in Hz"); % x-axis label
ylabel("Power in dBm"); % y-axis label
```

Stand Alone IQ

```
# -*- coding: utf-8 -*-
"""
Created on Wed Jul  8 14:21:47 2015

@author: austin
"""
from rawsocketconnection import RawSocketConnection
from scpi_wrappers.sleepyspawrapper import SleepySpaWrapper
from helpers.unitconversions import *

from helpers.iqhelpers import getDeltas
import time

import itertools
from multiprocessing import Pool
try:
    import matplotlib
    matplotlib.rcParams['axes.formatter.limits'] = [-4,4]
    from matplotlib import pyplot as plt
    import numpy as np

    plottingAvailable = True
except:
    plottingAvailable = False

try:
    from mayavi.mlab import quiver3d
    from mpl_toolkits.mplot3d import axes3d
    mayaviAvailable = True
except:
    mayaviAvailable = False

mayaviAvailable = False

def plotIQData(samples, timestep, figureText):
    print("Getting deltas")
    indexes, timevals, dt, inphase, di, quadphase, dq = getDeltas(samples)

    print("Sum of time steps: " + str(sum(dt[:-1])))
```

```
    pointLow = len(timevals) -60
    pointHigh = pointLow + 30
    for point in range(pointLow, pointHigh):
       print("Time: " + str(timevals[point] ) + " I: " + str(inphase[point]) + " Q:
" + str(quadphase[point]))

    assert(len(inphase) == len(quadphase))

    minPoint =0
    maxPoint = -1
    step = 1
    fig = plt.figure()
    ax1 = fig.add_subplot(321)
   ax1.scatter(inphase[minPoint:maxPoint:step], quadphase[minPoint:maxPoint:step],
marker = '.')
    ax1.set_xlabel("I")
    ax1.set_ylabel("Q")
    ax1.axis('equal')

    ax2 = fig.add_subplot(322)
    ax2.plot(indexes[minPoint:maxPoint:step], timevals[minPoint:maxPoint:step])
    ax2.set_xlabel("sample index")
    ax2.set_ylabel("Time since start in ns")

    ax3 = fig.add_subplot(323)
    ax3.scatter( indexes[minPoint:maxPoint:step],
dt[minPoint:maxPoint:step],marker='.')
    ax3.set_xlabel("sample index")
    ax3.set_ylabel("time step in ns")

    points = [x.Q + 1j * x.I for x in samples[:2**17]]

    #averageTimeStep = np.mean(dt)

    w = np.fft.fft(points)

    freqs = np.fft.fftfreq(len(points), d=timestep )

    ax4 = fig.add_subplot(324)
    ax4.plot( freqs,w.real)
```

```
    ax4.set_title("FFT")
    ax4.set_xlabel("Frequency Hz")
    ax4.set_ylabel("Amplitude (real part from FFT)")

    ax5 = fig.add_subplot(325)
    ax5.psd( points)

    ax6 = fig.add_subplot(326)
    ax6.text(0,0, figureText)

    ax6.set_axis_off()
    plt.tight_layout()

    global mayaviAvailable
    if mayaviAvailable:
        step =1
        minPoint = 0

        obj = quiver3d( np.array(timevals[minPoint:maxPoint:step])*1 ,
inphase[minPoint:maxPoint:step],
                    quadphase[minPoint:maxPoint:step],
np.array(dt[minPoint:maxPoint:step])*1,
                    di[minPoint:maxPoint:step], dq[minPoint:maxPoint:step])

        """
        obj = plot3d( np.array(timevals[minPoint:maxPoint:step])*10000 ,
inphase[minPoint:maxPoint:step],
                    quadphase[minPoint:maxPoint:step])

        obj = quiver3d( np.array(timevals[minPoint:maxPoint:step])*1 ,
inphase[minPoint:maxPoint:step],
                    quadphase[minPoint:maxPoint:step])
        """

    plt.show()

def test_iqTransfer(dut):
    """
    Verifies that the instrument can send IQ data
    """
    assert isinstance(dut, SleepySpaWrapper)
```

```
    #dut.preset()
    #dut._connection.sendQueryCommand("*opc?")
    #print(dut._connection.sendQueryCommand("*idn?"))
    iqBandwidth = 3 *MHz
    dut.setIqBandwidth(iqBandwidth)
    dut._connection.sendWriteCommand("IQ:BITS 24")
    dut._connection.sendWriteCommand("IQ:LENGth 0.1 s")

    dut.triggerIqCapture()
    dut.waitForOperationComplete()
    sampleSource = dut.queryIQData()

    timestep = sampleSource._nanosecondsPerSample *1e-9
    print ("Timestep: " + str(timestep))

    samples = [sample for sample in sampleSource.getSamples()]

    figureText = "Number of samples: " +str(len(samples)) +'\n
    figureText +="Time per tick in ns:
{:.3f}\n".format(sampleSource._nanosecondsPerTick)
    figureText +="DecimatedSampleRate: "+ str(sampleSource._decimatedSampleRate)+
'\n'
    figureText +="Ticks per sample: " + str(sampleSource._tickPerSample)+ '\n'
    figureText +="Time per sample in nanoseconds:
{:.3f}\n".format(sampleSource._nanosecondsPerSample)

    print (figureText)
    plotIQData(samples, timestep, figureText)

def test_streamPlot(dut):
    """
    Verifies that the instrument can send IQ data
    """
    assert isinstance(dut, SleepySpaWrapper)

    # This test requires a GPS fix since we need it for timestamp precision
    dut.waitForGpsFix()
    dut._connection.sendWriteCommand("IQ:BITS 8")

    iqBandwidth = 1330 *kHz
    dut.setIqBandwidth(iqBandwidth)
```

```
    dut.setIqStreaming()

    dut.triggerIqCapture()

    numChunks =10

    sampleSources = []
    for chunkNumber in range(numChunks):
        sampleSources.append( dut.queryIQData())

    dut.abortSweep()
    sampleSource = sampleSources[0]

    timestep = sampleSource._nanosecondsPerSample *1e-9
    print ("Timestep: " + str(timestep))

    samples = []
    for sampleSource in sampleSources:
        for sample in sampleSource.getSamples():
            samples.append(sample)

    figureText = "Number of samples: " +str(len(samples)) +'\n'
    figureText +="Time per tick in ns: " + str(sampleSource._nanosecondsPerTick)+
'\n'
    figureText +="DecimatedSampleRate: "+ str(sampleSource._decimatedSampleRate)+
'\n'
    figureText +="Ticks per sample: " + str(sampleSource._tickPerSample)+ '\n'
    figureText +="Time per sample in nanoseconds: " +
str(sampleSource._nanosecondsPerSample)+ '\n'

    print ("plotting")
    plotIQData(samples, timestep, figureText)




if __name__ == "__main__":
    import argparse
    parser = argparse.ArgumentParser(description='Runs iq plotting test')
    parser.add_argument('--address', dest='address', default= "172.26.202.128" )
    args = parser.parse_args()
    # edit this
```

```
    ipAddress = args.address + ":9001"
    connection = RawSocketConnection(ipAddress)

    dut = SleepySpaWrapper(connection, None)

# Change this to test_streamPlot(dut) if you want the streaming example
    test_iqTransfer(dut)
```

Histogram

```
from socketconnection import SocketConnection
from time import time
from math import log, ceil
connection = SocketConnection("172.26.201.208")
#connection._verbose = True

hist = {0:0}
count = 0
while True:
    start = time()
    connection.sendQueryCommand(":FREQ:START?")
    connection.sendQueryCommand(":FREQ:STOP?")
    connection.sendQueryCommand(":TRAC? 1")
    connection.sendQueryCommand(":TRAC? 1")
    connection.sendQueryCommand(":TRAC? 1")
    stop = time()
    delta = stop - start
    #print( delta)
    bucket = ceil(log(delta,2 ))
    #print( bucket)
    if bucket not in hist:
        hist[bucket] = 1
    else:
        hist[bucket] += 1
    count += 1
    if count == 10000:
        count = 0
        print("\nTime bucket, count")
        for key in sorted(hist):
            print("{},{}".format(2**key, hist[key] ))
```

I/Q Data Format

`The TRAC:IQ:DATA?` query returns a modified version of the SCPI standard (IEEE 488.2) block data format. The header contains three fields with a newline delimiter separating the header from the I/Q binary data:

#AXL\n: **A** is a single ASCII digit specifying the number of digits in X.

X is one or more ASCII digits specifying the number of bytes of binary I/Q data and ASCII GPS location coordinates.

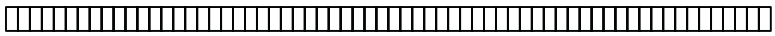
L is the ASCII string containing the GPS location in the form 'latitude, longitude' in decimal degrees. The coordinates record where the I/Q capture was triggered.

\n is a single byte newline delimiter marking the end of the GPS location component and start of the I/Q data. The I/Q data is in binary format and is described below.

I/Q Frame Structure

I/Q data is organized into two levels: frame and extended frame. The lowest level is a 64 bit frame. which may contain one to four I/Q sample pairs depending on the selected I/Q bit resolution. The second level is an extended frame which can be used for the stamp information. The first column of the IQ vector contains Q and the second column contains I.

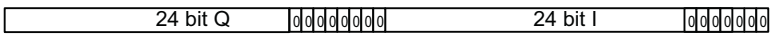
64 bit Frame



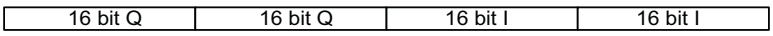
The 64 bit frame contains one to four I/Q sample pairs depending on the selected I/Q bit resolution.

I/Q Bit Resolution	IQ Sample Pairs per 64 Bit Frame
24	1
16	2
10	3
8	4

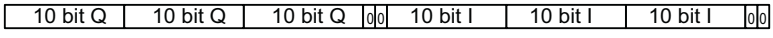
24 Bit Resolution



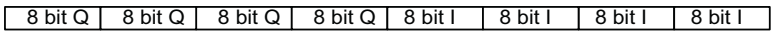
16 Bit Resolution



10 Bit Resolution



8 Bit Resolution

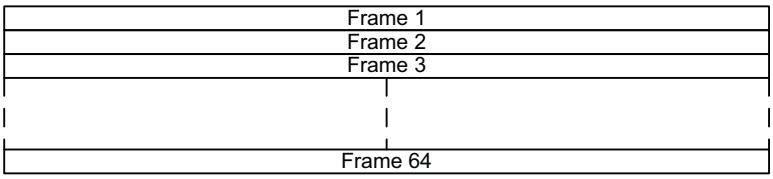


Note	The frame structure will be modified slightly when there is a time stamp. This will be described in a later section.

I/Q Extended Frame

An extended frame consists of 64 frames. When time stamp information is used, each frame contains one bit of a 64 bit time stamp data. An extended frame is 64 frames that contain a time stamp.

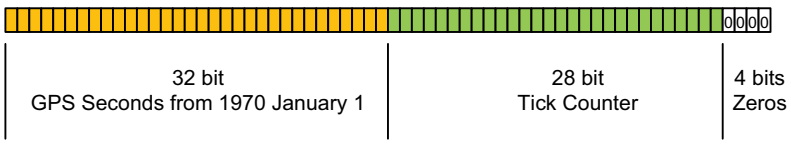
Extended Frame



I/Q Time Stamp

This section describes how the time stamp is embedded into the I/Q data. Within each 64 bit frame, only the first four extended frames contain time stamp information. Refer to 64 bit Time Stamp frame diagram below.

64 bit Time Stamp

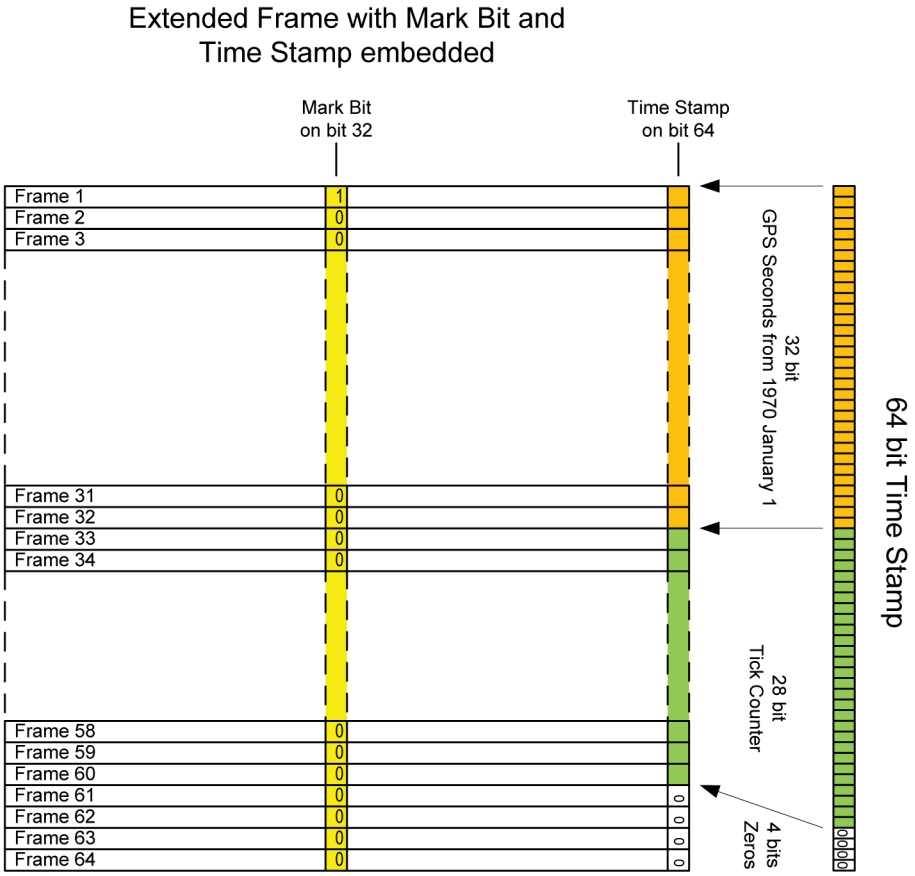


The GPS seconds is the time in seconds from Jan 1, 1970. The tick counter counts at a rate of 114.375 MHz and it is reset to 0 on every second, triggered by the GPS PPS signal.

The time stamp records the time at the beginning of each extended frame. The elapsed time between each frame is calculated with this formula:

$$Elapsed\ Time\ Between\ Each\ Frame = \frac{1}{Output\ Data\ Rate} \times IQ\ Sample\ Pairs\ per\ Frame$$

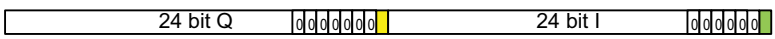
To insert the time stamp without interrupting the I/Q data sequence, the 64 bit time stamp is rotated and inserted into the extended frame by using bit 64 from each frame. To indicate the beginning of an extended frame with a time stamp, a mark bit is set to '1' for the first frame and '0' for the remaining 63 frames. The mark bit uses bit 32 of each frame.



I/Q Frame Structure with Time Stamp

Embedding the time stamp requires using two bits from each frame, which requires modifying the I/Q frame structure.

I/Q Bit Resolution = 24



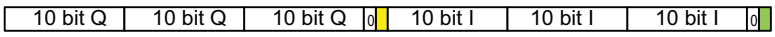
Each frame contains only 1 I/Q sample pair (one I and one Q). The first column of the IQ vector contains Q and the second column contains I. All the frames will have 24 bits each for I and Q. Each I and Q sample is followed by 7 zeros, then the mark or time stamp bit. Only the first four extended frames will have time stamping.

The remaining extended frames will have zero valued mark and time stamp bit.

I/Q Bit Resolution = 16

Each frame contains two I/Q sample pairs (two I and two Q). The first I and first Q sample in the frame will always have 16 bits. The second I and second Q sample will have 15 bits, followed by the mark and time stamp bit.

I/Q Bit Resolution = 10



Each frame contains three I/Q sample pairs (three I and three Q). All the frames will have 10 bits each for I and Q. Each I and Q sample is followed by one zero, then the mark or time stamp bit. Only the first four extended frames will have time stamping.

The remaining extended frames will have zero valued mark and time stamp bit.

I/Q Bit Resolution = 8

Each frame contains four I/Q sample pairs (four I and four Q). The first three I and first three Q samples in the frame will always have 8 bits. The fourth I and fourth Q sample will have 7 bits if the frame is in the first four extended frames, which uses one bit for mark and one bit for the time stamp.

Having only 7 effective bits instead of 8 bits on every fourth sample will slightly increase the noise floor.

Time Stamp Boundary Conditions

Note	Sometimes, the first mark bit does not always begin with at the start of the I/Q capture. There could be a number of I/Q samples recorded before the first time the mark bit is set to 1. In the example below, there are 5 frames before the first timestamp, which doesn't start until the sixth frame. The first column of the IQ vector contains Q and the second column contains I.

N Frame Data (one I, one Q sample per frame)

0 [Q-------0I-------T]

1 [Q-------0I-------T]

2 [Q-------0I-------T]

3 [Q-------0I-------T]

4 [Q-------0I-------T]

5 [Q-------0I-------T] <- The first mark bit is here. This is where you start to build the first timestamp; this 'T' is the MSB of the timestamp

6 [Q-------0I-------T] <- 'T' is MSB - 1 bit of the timestamp

7 [Q-------0I-------T] <- 'T' is MSB - 2 bit of the timestamp

8 [Q-------0I-------T] <- etc.

...

To get the timestamp for frames N=0 though N=4, you must extrapolate the timestamp from frame 5 backwards. To get the timestamps for frames 6-68, you must extrapolate the timestamp forwards. The time between each frame is equal to (1/Output Data Rate)x(Number of I or Q samples per frame).

I/Q Bit Resolution	Time Between Each Frame
24	1/(Output Data Rate)
16	2/(Output Data Rate)
10	3/(Output Data Rate)
8	4/(Output Data Rate)

Once the 64 bits of timestamp is put together, you get a number that looks like:

[S-------T-----0000]

Where 'S-------' is 32 bits specifying the timestamp in seconds since 1970 (time_t), 'T-----' is 28 bits specifying the offset from that second (in clock ticks at 114.375MHz), and '0000' are 4 unused bits.

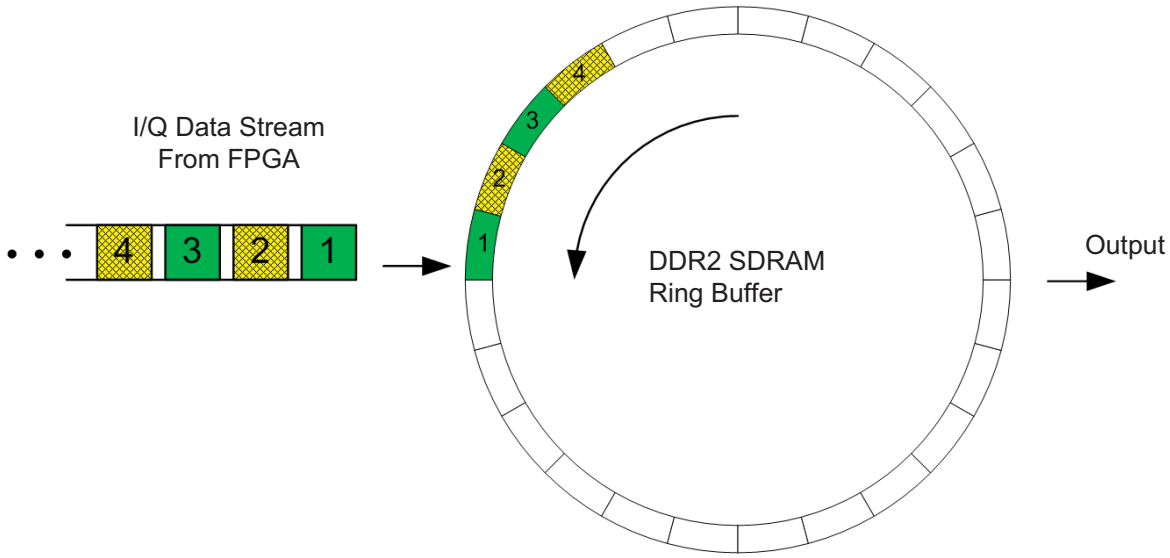
Note	There could be some frames at the very end of the capture that have an incomplete timestamp because the capture stops before there is a complete group of 64 frames to make an extended frame . In that case you could extrapolate from the previous timestamp.

I/Q Capture Streaming Mode

Data Capture to Buffer Memory

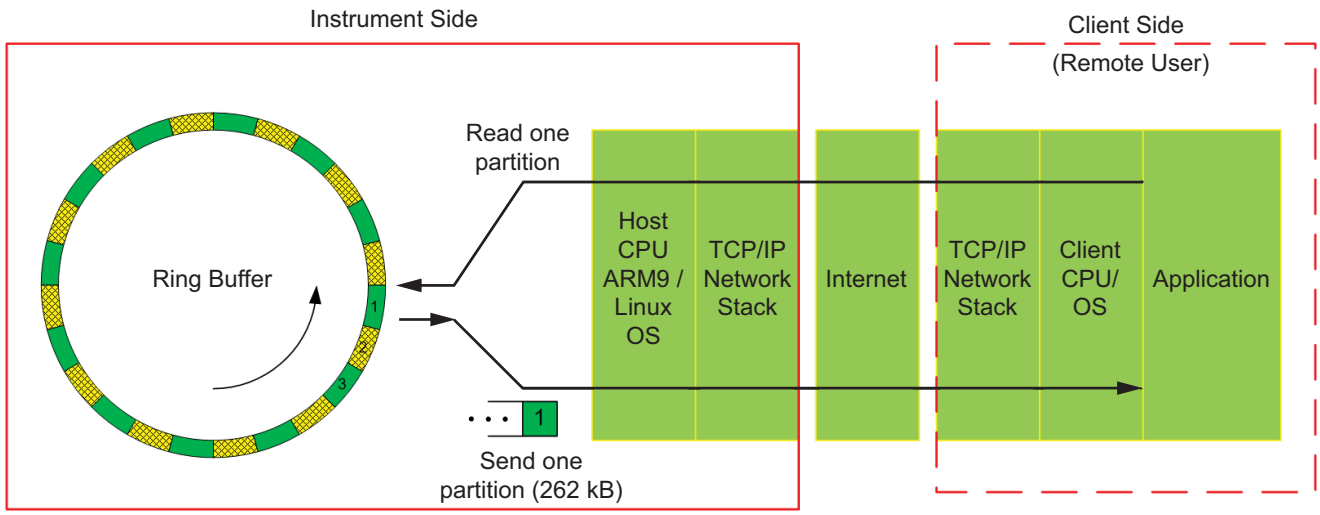
In streaming, the I/Q data uses the same frame, extended frame structure as in block mode.

I/Q data is captured to high speed DDR2 SDRAM memory, configured as a ring buffer. The buffer memory is 256 MB (256 x 1024^2 bytes) and it is divided into 1024 partitions. Each partition is 262,144 bytes, which holds 32,768 I/Q frames. I/Q data fills each partition in sequence. The data stream rate to memory is determined by the selected I/Q bandwidth. When the buffer is full, new I/Q data is stored from the first partition again.



Data Transmission to Remote User

When the I/Q is sent out from the memory to the remote user, the data flow rate has to be managed. The simplest way to manage the data flow is to send out one partition and wait for a read command from the remote user before sending another partition. The user may not be able to receive all the partitions if the read command for each partition is delayed due to latency in the CPU, OS, network, and user application. The I/Q data is continuously filling the memory partitions at a rate proportional to the selected I/Q capture bandwidth. If the read command arrives after the start of a partition, that partition is skipped and will not be sent. The next partition will be sent instead.



I/Q Streaming Capture via SCPI

```
SENS:FREQ:CENTER 100 MHz
SENS:FREQ:SPAN 20 MHz
SWEEP:MODE FFT
//Set RBW 30 kHz
BANDWIDTH 30 KHz
//Set Reference Level to -30 dBm
DISP:WIND:TRAC:Y:SCAL:RLEV -30
//Set to single sweep
INIT:CONT OFF
//abort any sweep in progress
:ABORT


//Set Capture bandwidth. Not same as RBW.
IQ:BANDWIDTH 20 MHz


//Set 16 bit resolution
IQ:BITS 16


//streaming block capture
IQ:MODE STREAM
//enable time stamp
SENS:IQ:TIME 1


//Start IQ Capture. Triggers streaming capture. Data is continuously saved to DDR2
memory in a ring buffer.


MEAS:IQ:CAPT


//Use loop to continuously send command to retrieve I/Q data partitions and parse
data as it is being received.


LOOP BEGIN
     //Get most recent I/Q partition from memory.
     TRAC:IQ:DATA?


     //Check if capture is aborted.
     STATus:OPERation?


     //If capture is not aborted, parse data and decode time stamp for the received
     data
     LOOP END
```

To read the I/Q data, use the TRAC:IQ:DATA? SCPI command. This returns the partition with the most recently captured I/Q data. During streaming, the client has to continuously send TRAC:IQ:DATA? SCPI command to another partition's I/Q data.

The capture of I/Q data and filling of partitions will continue until it is aborted with the :ABORT command or other commands that change frequency or attenuation settings. To determine if the capture was aborted, check the output of STATus:OPERation?.

The STATus:OPERation? query responds with a integer. Convert this integer to binary.
Bit 9 is set to 1 when the MEAS:IQ:CAPT command is issued.
Bit 9 is set to 0 if the capture is aborted by :ABORT command or other command which invalidates the capture.

Error Conditions: Overpower or Overheat

The I/Q capture will be paused if the instrument detects an overpower or overheat condition. In this situation, any pending TRAC:IQ:DATA? query will immediately return #0 and a device-specific error will be added to the SCPI error queue. When the condition is rectified, the capture will automatically restart. For example, if there was an overpower event, remove the overpower source and close the overpower relay. If there was an overheat event, wait for the instrument to cool down.

Error Condition: Timing Reference Source Change

If the instrument detects any of the four conditions below, a device-specific error will be added to the SCPI error queue. In either block or streaming mode, the instrument will not abort a capture that is already in progress.

1. Loss of GPS
2. Newly acquired GPS lock
3. Disconnect/Connect External Reference
4. Large timing drift during GPS Hi-Accuracy Mode

5-10 SCPI Command Files

Refer to the following for the programming commands:

- Chapter 6, "SCPI SPA Commands"
- Chapter 7, "SCPI System Commands"

Refer to the following for SCPI error definitions and Command Listing:

- Appendix C, "SCPI Error Table"
- Appendix B, "SCPI Command Listing"

Chapter 6 — SCPI Commands

6-1 Introduction

SCPI SPA commands control all instrument spectrum analyzer functions and some general purpose functions.

6-2 Common Commands

***CLS**

Title: Clear Status Command

Description: This command clears all status data structures in the device (registers and error queue) and forces the Operation Complete state to Idle.

***ESE <numeric_value>**
***ESE?**

Title: Standard Event Status Enable

Description: This command provides access the Standard Event Status Enable Register. Refer to IEEE 488.2 for more information on the contents of this register. Value ranges from 0 to 255.

Parameter(s): <numeric_value>

***ESR?**

Title: Standard Event Status

Description: This command queries the Standard Event Status Register. Refer to IEEE 488.2 for more information on the contents of this register.

***IDN?**

Title: Identify

Description: This command returns the following information in <string> format separated by commas: manufacturer name ("Anritsu"), model number/options, serial number, firmware package number. The model number and options are separated by a "/" and each option is separated by a "/".

***OPC**
***OPC?**

Title: Operation Complete

Description: The *OPC command causes the device to set the OPC bit of the Standard Event Status Register on the next transition of the No Operation Pending flag from false to true. The *OPC? command returns 1 in the response whenever the No Operation Pending Flag is true.

***RST**

Title: Reset

Description: <MS2710xA> This command reboots the instrument. Note that the instrument will power-cycle after this command is executed and the IP address might change if the Ethernet configuration is set to DHCP. After executing this command communication will be lost. Wait a minimum of 30 seconds before re-establishing communication.

***SRE <numeric_value>**
***SRE?**

Title: Service Request Enable

Description: This command provides access to the Service Request Enable Register. Refer to IEEE 488.2 for more information on the contents of this register.

Parameter(s): <numeric_value>

***STB?**

Title: Status Byte Query

Description: This command queries the Status Byte Register. Refer to IEEE 488.2 for more information on the contents of this register.

***WAI**

Title: Wait-to-Continue Command

Description: This command causes the device to execute no further commands or queries until the No Operation Pending flag is TRUE.

6-3 :DIAGnostic Subsystem

:DIAGnostic:MEMory?

Title: Used Memory

Description: This command returns the total memory available on the instrument, the free memory, and the memory used by the backend process in kB. If the instrument runs into an error while retrieving system memory data, "nan,nan,nan" will be returned as the response and a "-100" (SCPI command error) will be placed in the SCPI error queue.

6-4 :FETCh Subsystem

Use this command to get GPS information.

:FETCh:GPS?

Title: Basic GPS Information

Description: This command returns the timestamp, latitude, and longitude of the device. The response is a comma-delimited ASCII response of one of the following forms: NO FIX or GOOD FIX,<timestamp>,<latitude>,<longitude> If no GPS fix is currently available, the first response form (NO FIX) is returned. If the GPS does have a fix, the second response form (GOOD FIX) is returned. <timestamp> is in ISO8601 format. The timestamp provides the 24-hour time, and will include the year/date and/or UTC offset if the hardware supports it. If no UTC offset is provided, the time is in UTC time. <latitude> and <longitude> are specified in decimal degrees.

:FETCh:GPS:FULL?

Title: Full GPS Information

Description: This command returns the timestamp, latitude, longitude, altitude, and satellite count of the device. The response is a comma-delimited ASCII response of one of the following forms: NO FIX or GOOD FIX,<timestamp>,<latitude>,<longitude>,<altitude>,<satellites> If no GPS fix is currently available, the first response form (NO FIX) is returned. If the GPS does have a fix, the second response form (GOOD FIX) is returned. <timestamp> is in ISO8601 format. The timestamp provides the 24-hour time, and will include the year/date and/or UTC offset if the hardware supports it. If no UTC offset is provided, the time is in UTC time. <latitude> and <longitude> are specified in decimal degrees. <altitude> specifies the current altitude relative to mean sea level, in meters. <satellites> specifies an integer count of the number of satellites currently used in the fix.

:FETCh:GPS:LAST?

Title: Last GPS Fix

Description: This command returns the timestamp, latitude, longitude, and altitude of the last fixed GPS result. The response is a comma-delimited ASCII response of one of the following forms: NO FIX or GOOD FIX,<timestamp>,<latitude>,<longitude>,<altitude> If a GPS fix has never been acquired, the first response form (NO FIX) is returned. If a GPS fix was previously acquired, the second response form (GOOD FIX) is returned. <timestamp> is in ISO8601 format. The timestamp provides the 24-hour time, and will include the year/date and/or UTC offset if the hardware supports it. If no UTC offset is provided, the time is in UTC time. <latitude> and <longitude> are specified in decimal degrees. <altitude> specifies the current altitude relative to mean sea level, in meters.

6-5 :INSTrument Subsystem

One instrument may contain many logical instruments (“modes”). This subsystem controls the selection of the current instrument mode.

:INSTrument:APPLication:STATe <SPA>,<0 | 1 | ON | OFF>

Title: Activate or Deactivate Application

Description: This command turns the specified application ON or OFF. When an application is turned ON (i.e. activated), it is loaded into memory and can be used to make measurements. An application must be activated before it will respond to commands. When an application is turned OFF (i.e. deactivated), any measurements it is making are stopped and it is unloaded from memory. Attempting to turn ON the same application twice or turn OFF an application that is not currently ON is not permitted and will result in an execution error (-200). Unlike INSTrument:SELect, which selects a given application and makes it active if it is not already active, this command can be used to activate an application without selecting it. If the requested application is the selected application (which can be queried with INSTrument:SELect?), turning it OFF will cause the current application selection to automatically change to whatever active application, of those remaining, was turned ON last. For example, consider an instrument with Spectrum Analyzer, VNA, and Power Meter applications available. After the following compound command sequence INST:SEL "spa"; APPL:STAT "vna" ON; APPL:STAT "pm" ON; APPL:STAT "spa" OFF the currently selected application will be "pm". If the last active application is turned OFF, the current application selection will be reported as NONE via INSTrument:SELect?. This command takes two parameters. The first parameter is a string value that specifies which application should be turned ON or OFF. The permitted values of this parameter are the same as those used by the INSTrument:SELect command. The second parameter is a Boolean value that specifies whether the application should be turned ON or OFF. After a reset, the default selected application is always active, and all other applications are inactive.

Parameter(s): <SPA>,<0 | 1 | ON | OFF>

:INSTrument:CATalog:ACTive?

Title: List Active Applications

Description: This command queries all active applications. The response is returned as a comma delimited list of application names. The application names are the same as those returned by the INSTrument:CATalog:FULL? query or used as parameters to the INSTrument:SELect command. If no applications are currently active, this query will return NONE.

:INSTrument:CATalog:FULL?

Title: Query Available Modes

Description: This query returns a list of string - number pairs. The string contains the name of the available application. The immediately following NR1-formatted number is its associated application number. All response data elements are comma separated. If no application is available, a null string followed by a zero is returned.

:INSTrument:NSELect <numeric_value>
:INSTrument:NSELect?

Title: Select Mode by Number

Description: Sets the selected application based on the value of <integer>. The query version returns the number associated with the current application. The list of valid integers and the applications they correspond to can be queried with INSTrument:CATalog:FULL? If no applications are active, the query version of this command will return 0.

Parameter(s): <numeric_value>

:INSTrument[:SELect] <SPA>
:INSTrument[:SELect]?

Title: Select Mode by Name

Description: Sets the selected application based on the application name specified by <identifier>. The <identifier> is a valid application name (character data). The list of valid application names can be queried with INSTrument:CATalog:FULL? The query version returns the name of the current application. If no applications are active, the query version of this command will return NONE.

Parameter(s): <SPA>

6-6 :MMEMory Subsystem

The commands in the Mass MEMory subsystem contain functions that provide access to the instrument setup and data storage.

:MMEMory:CATalog:DIRectory? <string>,<string>

Title: Memory Catalog Directory

Description: Returns the non-recursive contents of the memory specified by the MSUS and DIRECTORY parameters. Both parameters are case sensitive. Parameter 1: Directory. Use "/" as a directory separator. Note that this parameter should NOT be an empty string. To access the root directory, pass in "/" as the first parameter. Parameter 2: MSUS (Use :MMEMory:CATalog:MSUSs query command to retrieve the list of available storage devices). The response is formated as follows: <total space used on MSUS>,<total space available on MSUS>,{<file entry1>},..{<file entryN>} where <file entry> is: <file or directory name>,<file type>,<file size>

Parameter(s): <string>,<string>

:MMEMory:CATalog:MSUSs?

Title: Memory Catalog Msuss

Description: Returns a list of all available mass storage devices present, formated as follows: <Device Name 1>,<Device Name 2>,...<Device Name N>

:MMEMory:CDIRectory <string>
:MMEMory:CDIRectory?

Title: Default Mass Storage Directory

Description: This command selects the default directory on the default mass storage device (see :MMEMory:MSIS) for use with MMEMory commands. The parameter is case sensitive. Use "/" as a directory separator. The set command will fail and an error is reported if the requested directory does not exist. Note that the query command returns the name of the default directory that was previously set and the device does not check whether the directory is still present.

Parameter(s): <string>

Default Value: /

:MMEMory:COPY <string>,<string>,<string>,<string>

Title: Copy File

Description: This command copies the specified source file into a new file located at the specified destination location. Four parameters are required for this command: 1. Source File Location: The file path to the file to be copied. 2. Source MSUS: The mass storage device the file is located in (i.e. Internal). 3. Destination File Location: The destination file path that the file should be copied to. 4. Destination MSUS: The mass storage device that the destination file should be written to (i.e. Internal). Please note that if a file already exists at the destination location or if the source file does not exist, the command will fail to execute and add an execution error into the SCPI error queue. This command will only copy files. If a directory path is passed in as a parameter, the command will fail to execute.

Parameter(s): <string>,<string>,<string>,<string>

:MMEMory:CREate:DIRectory <string>,<string>

Title: Create Directory

Description: Creates a directory at the specified mass storage device. Both parameters are case sensitive. Parameter 1: Directory. Use "/" as a directory separator. Parameter 2: MSUS (Use :MMEMory:CATalog:MSUSs query command to retrieve the list of available storage devices) If the intermediate directories in the path don't exist, the command will automatically create them. Common causes of the command failure are: - The MSUS device is not present (Use :MMEMory:CATalog:MSUSs query command to retrieve the list of available storage devices) - The total space available on MSUS device is not big enough (Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on MSUS)

Parameter(s): <string>,<string>

:MMEMory:DATA <string>,<string>,<block data>
:MMEMory:DATA? <string>,<string>

Title: File Transfer

Description: This command imports/exports a file to/from the instrument. Data is transferred to/from the instrument as an IEEE definite length arbitrary block response, which has the form <header><block>. This set command takes three parameters. 1. File Path: The path of the file to be written 2. MSUS: The mass storage device to write the file to 3. Block Data: The data to be written to the instrument in block data format If any directories in the file path do not exist, the instrument will automatically create the required directories. Please note that the maximum file transfer size to the instrument is 25 MB. The ASCII header specifies the number of data bytes of the file. It looks like #AX, where A is the number of digits in X and X is the number of bytes in the <block>. The first character is the literal ascii hash '#' 043. The second character (A) is a single ascii digit '1' to '9' describing the number of bytes in the length section (X). This number is called nlength. The next nlength bytes make up an ascii string of digits '1' to '9' describing the length of the <block> data. For example, if the first 6 bytes are #49999, then the nlength is 4. The 4 bytes of length are 9999. After that follows the <block>, which would be 9999 bytes in size. The query command takes two parameters. 1. File Path: The path to the file to be retrieved. 2. Msus: The mass storage device to retrieve the file from. The file is returned in block data format with an ASCII header The query command will return a #10 if the file cannot be found.

Set Command Parameter(s): <string>,<string>,<block data>

Query Command Parameter(s): <string>,<string>

:MMEMory:DELete:DIRectory <string>,<string>

Title: Delete Directory

Description: Deletes the specified directory and all its content at the specified mass storage device. The two parameters for this command are directory name and mass storage device. Both parameters are case sensitive. Use "/" as a directory separator. To delete the root folder in a specified mass storage device, enter "/" for directory name parameter. The available mass storage devices can be retrieved by using the :MMEMory:CATalog:MSUSs command. The command will fail if the directory doesn't exist or the mass storage device is not present.

Parameter(s): <string>,<string>

:MMEMory:DELete:FILe <string>,<string>

Title: Delete File

Description: Deletes the specified file at the specified mass storage device. The two parameters for this command are file name with relative path and mass storage device. Both parameters are case sensitive. Use "/" as a directory separator. The available mass storage devices can be retrieved by the :MMEMory:CATalog:MSUSs command. The command will fail if the file doesn't exist or the mass storage device is not present.

Parameter(s): <string>,<string>

:MMEMory:LOAD:STATe <numeric_value>,<string>,<string>

Title: Load State

Description: This command recalls the specified setup. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive. Parameters: 1. Numeric Value: currently unused. Send a 0. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension is optional. 3. MSUS: Device to recall the file from. See MMEMory:CATalog:MSUSs? for information on obtaining the list of available devices. The model of the device that the setup was created in must match the model of the device to recall in; otherwise, the recall will be rejected. The options of the device that the setup was created in must be enabled in the device to recall in; otherwise, the recall will be rejected.

Parameter(s): <numeric_value>,<string>,<string>

:MMEMory:LOAD:TRACe <string>,<string>,<string>

Title: Load Trace

Description: This command recalls the specified measurement. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive. Parameters: 1. Label: Used to specify which trace to recall. Currently, the label only supports recalling all traces. Send an empty string or "ALL" to load all traces. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension is optional. 3. MSUS: Device to recall the file from. See MMEMory:CATalog:MSUSs? for information on obtaining the list of available devices. The model of the device that the measurement was saved in must match the model of the device to recall in; otherwise, the recall will be rejected. The options of the device that the measurement was saved in must be enabled in the device to recall in; otherwise, the recall will be rejected.

Parameter(s): <string>,<string>,<string>

:MMEMory:LOAD:TRACe:EXIT <LOADprevious|KEEPcurrent>

Title: Exit Recall State

Description: This command exits recall state if the instrument currently has a measurement file recalled. An enumerable parameter is accepted to determine whether to revert back to the setup prior to recalling a measurement (LOADprevious) or to keep the setup from the measurement file (KEEPcurrent).

Parameter(s): <LOADprevious | KEEPcurrent>

:MMEMory:LOAD:TRACe:STATus?

Title: Get Recall State Status

Description: This command retrieves the status of whether or not the instrument is in a state where a measurement file has been recalled. A return value of 0 means that the instrument is not in a state where a measurement file has been recalled. A return value of 1 means that the instrument has recalled a measurement file and is in a state where SCPI commands are restricted. To exit this state, use the :MMEMory:LOAD:TRACe:EXIT SCPI command.

:MMEMory:LOAD:LIMit <string>,<string>,<string>

Title: Load Limit From File

Description: This command loads limit data from the specified limit file. The file location is resolved using the MSUS and file path parameters. Parameters: 1. Label: Used to specify which limit to load. Currently, the label only supports loading all limits. Send an empty string or "ALL" to load all limits. 2. File path: The file path (including file name) relative to the MSUS root directory. File path is case sensitive. File extension is optional. 3. MSUS: Device to load the file from. See MMEMory:MSUSs? for information on obtaining the list of available devices. MSUS parameter is case sensitive. The model of the device that the limit was saved in must match the model of the the device to load in; otherwise, the load will be rejected.

Parameter(s): <string>,<string>,<string>

:MMEMory:LOAD:RAM <numeric_value>,<numeric_value>,<string>

Title: Load RAM

Description: Load data from RAM to a file. This command takes three parameters 1. data block size: that needs to be loaded in bytes (must be a word aligned) 2. offset: in bytes from start of RAM address to load from 3. filename: name of the file without the full path. This is the destination file where the contents of RAM are copied over

Parameter(s): <numeric_value>,<numeric_value>,<string>

:MMEMory:MSIS <string>
:MMEMory:MSIS?

Title: Default Mass Storage Device

Description: This command selects the default device for use with MMEMory commands. The mass storage device parameter is case sensitive and must match a device returned from the :MMEMory:CATalog:MSUSs? command

Parameter(s): <string>

Default Value: Internal

:MMEMory:STOEvent:CLEarall

Title: Clear All Save On Event

Description: Turns off all save on event types that are active.

:MMEMory:STOEvent:EOSWeep:MODE <CONTinuous|SINGle>
:MMEMory:STOEvent:EOSWeep:MODE?

Title: End of Sweep Save On Event Mode

Description: Specifies the stop mode of the end of sweep save on event system. Setting the value to CONTinuous will cause the instrument to keep saving traces at the completion of every valid sweep. Setting the value to SINGle will trigger a save trace on the next complete valid sweep and then automatically turn the end of sweep save on event feature OFF.

Parameter(s): <CONTinuous|SINGle>

Query Return: CONT|SING

Default Value: CONTinuous

:MMEMory:STOEvent:EOSWeep[:STATe] <0 | 1 | ON | OFF>
:MMEMory:STOEvent:EOSWeep[:STATe]?

Title: End of Sweep Save on Event State

Description: Turn the end of sweep save on event ON or OFF. Turning the feature on will cause the instrument to automatically save a trace whenever a sweep completes. A common cause of the command failure is not having enough space available on the storage location. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on the storage location.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:MMEMory:STOEvent:LIMit:INTerval <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum
:MMEMory:STOEvent:LIMit:INTerval? [DEFault | MINimum | MAXimum]

Title: Limit Save On Event Interval

Description: Sets the time interval to keep saving after a limit line failure has occured when :MMEMory:STOEvent:LIMit:MODE is set to INTerval.

Query Return: Numeric (ms)

Set Command Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 60000 ms

Default Unit: ms

Range: 0 ms to 216000000 ms

:MMEMory:STOEvent:LIMit:MODE <CONTinuous|SINGle|INTerval>
:MMEMory:STOEvent:LIMit:MODE?

Title: End of Sweep Save On Event Mode

Description: Specifies the stop mode of the limit save on event system. Setting the value to CONTinuous will cause the instrument to keep saving traces at every limit line failure. Setting the value to SINGle will trigger a save trace on the next limit line failure and then automatically turn the end of sweep save on event feature OFF automatically. Setting the value to INTerval will trigger a save on the next limit line failure and continue to save at every end of sweep until the set time interval has expired.

Parameter(s): <CONTinuous | SINGle | INTerval>

Query Return: CONT | SING | INT

Default Value: CONTinuous

:MMEMory:STOEvent:LIMit:PTRigger[:STATe] <0 | 1 | ON | OFF>
:MMEMory:STOEvent:LIMit:PTRigger[:STATe]?

Title: Limit Pretrigger Save on Event State

Description: Turn the limit pre-trigger save on event ON or OFF. Turning the feature ON will cause the instrument to automatically save a trace captured prior to the limit line failure trace. The :MMEMory:STOEvent:LIMit[:STATe] and :INITiate:CONTinuous needs to be turned ON for the pre-trigger feature to apply. A common cause of the command failure is not having enough space available on the storage location. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on the storage location.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:MMEMory:STOEvent:LIMit[:STATe] <0 | 1 | ON | OFF>
:MMEMory:STOEvent:LIMit[:STATe]?

Title: Limit Save on Event State

Description: Turn the limit save on event ON or OFF. Turning the feature on will cause the instrument to automatically save a trace whenever a limit line failure occurs. A common cause of the command failure is not having enough space available on the storage location. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on the storage location.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:MMEMory:STOEvent:TIMer:INTerval <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum
:MMEMory:STOEvent:TIMer:INTerval? [DEFault | MINimum | MAXimum]

Title: Timer Save On Event Interval

Description: Sets the time interval to save when :MMEMory:STOEvent:TIMer[:STATe] is enabled. The queried value is always in milliseconds.

Query Return: Numeric (ms)

Set Command Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 240000 ms

Default Unit: ms

Range: 0 ms to 3600000 ms

:MMEMory:STOEvent:TIMer:SIZe <numeric_value> | DEFault | MINimum | MAXimum
:MMEMory:STOEvent:TIMer:SIZe? [DEFault | MINimum | MAXimum]

Title: Limit Save on Event Size

Description: Specify the total size, in bytes, the timer save on event will utilize. This feature prevents the save-on-event timer from filling the memory of the specified mass storage device. If the size specified is exceeded, subsequent timer expirations will cause the oldest save-on-event timer file to be deleted and replaced with the new measurement file. The total size only applies to the current directory (as specified by :MMEMory:MSIS and :MMEMory:CDIRectory).

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 1000000

Range: 1000 to 1000000000000

:MMEMory:STOEvent:TIMer[:STATe] <0 | 1 | ON | OFF>
:MMEMory:STOEvent:TIMer[:STATe]?

Title: Limit Save on Event State

Description: Turn the timer save on event ON or OFF. Turning the feature on will cause the instrument to automatically save a trace at the interval specified by :MMEMory:STOEvent:LIMit:INTerval, if space is available. Available memory may be checked using :MMEMory:CATalog:DIRectory query command.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:MMEMory:STORe:LIMit <string>,<string>,<string>

Title: Store Limit To File

Description: This command stores the limit data into the specified file location. The file location is resolved using the MSUS and file path parameters. Intermediate folders specified by the file path parameter are automatically created. The output file extension is .lim. The command automatically overwrites the specified file if present. Parameters: 1. Label: Used to specify which limit to store. Currently, the label only supports storing all limits. Send an empty string or "ALL" to store all limits. 2. File path: The file path (including file name) relative to the MSUS root directory. File path is case sensitive. File extension is optional. 3. MSUS: Device to store the file to. See MMEMory:MSUSs? for information on obtaining the list of available devices. MSUS parameter is case sensitive. A common cause of the command failure is not having enough space available on the storage location. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on the storage location.

Parameter(s): <string>,<string>,<string>

:MMEMory:STORe:RAM <numeric_value>,<numeric_value>,<string>

Title: Store RAM

Description: Store data to RAM from a file. This command takes three parameters 1. data block size: that needs to be stored in bytes (must be a word aligned) 2. offset: in bytes from start of RAM address to store data at 3. filename: name of the file without the full path. Contents of this file will be copied over to RAM

Parameter(s): <numeric_value>,<numeric_value>,<string>

:MMEMory:STORe:STATe <numeric_value>,<string>,<string>

Title: Store State

Description: This command saves the current setup to the specified file location. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive. If a file with the resolved name already exists, it will be overwritten. Parameters: 1. Numeric Value: currently unused. Send a 0. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension should not be specified. 3. MSUS: Device to save the file on. See MMEMory:CATalog:MSUSs? for information on obtaining the list of available devices. A common cause of the command failure is not having enough space available on MSUS to save the setup. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on MSUS.

Parameter(s): <numeric_value>,<string>,<string>

:MMEMory:STORe:TRACe <string>,<string>,<string>

Title: Store Trace

Description: This command saves the current trace to the specified file location. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive. Parameters: 1. Label: Used to specify which trace to save. Currently, the label only supports saving all traces. Send an empty string or "ALL" to store all traces. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension should not be specified. 3. MSUS: Device to save the file on. See MMEMory:CATalog:MSUSs? for information on obtaining the list of available devices. A common cause of the command failure is not having enough space available on MSUS to save trace. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on MSUS.

Parameter(s): <string>,<string>,<string>

6-7 :SYSTem Subsystem

This subsystem contains commands that affect instrument functionality that does not directly relate to data collection, display or transfer.

:SYSTem:COMMunicate:LAN:CONFig <string>,<string>,<string>
:SYSTem:COMMunicate:LAN:CONFig?

Title: Static LAN Configuration

Description: This command set and queries the static ethernet configuration of the device. The static configuration allows user to specify the ip, gateway, and subnet mask of the unit on a network. Parameters: - Static IP Address: The desired IP address of the unit. - Gateway: The network gateway. - Subnet Mask: the subnet mask of the network the device is connected to. A new valid configuration will automatically be applied to the device. The user will be required to access the unit through the new configuration. CAUTION: Consult with your network administrator when configuring the network interface to avoid potential loss of access or discovery of the device.

Parameter(s): <string>,<string>,<string>

:SYSTem:COMMunicate:LAN:CONFig:CURRent?

Title: Current LAN Configuration

Description: This command queries the current ethernet configuration of the device.

:SYSTem:COMMunicate:LAN:DHCP <ON|OFF>
:SYSTem:COMMunicate:LAN:DHCP?

Title: DHCP Configuration

Description: This command sets and queries the DHCP configuration of the device. If the DHCP configuration is set to OFF, the device is configured to the static ethernet configuration (See :SYSTem:COMMunicate:LAN:CONFig). If the DHCP configuration is set to ON, the device will obtain its IP address, gateway, and subnet mask from the DHCP server in the network. This set command should be used to caution, as changing the ethernet configuration will result in temporary loss of communication with the device. CAUTION: Consult with your network administrator when configuring the network interface to avoid potential loss of access or discovery of the device.

Parameter(s): <ON|OFF>

Query Return: ON|OFF

Default Value: OFF

:SYSTem:COMMunicate:LAN:DNS <string>,<string>,<string>
:SYSTem:COMMunicate:LAN:DNS?

Title: Dynamic DNS Configuration

Description: This command sets and queries the Dynamic Domain Name Server (Dynamic DNS) configuration of the device. Currently, only http://www.noip.com (TM) is available for use. For support, please contact the vendor at http:/\noip.com. Parameters: - Dynamic DNS NoIp.com Host Name: Desired host name of the device. - Dynamic DNS NoIp.com Username: noip.com username. - Dynamic DNS NoIp.com Password: noip.com password.

Parameter(s): <string>,<string>,<string>

:SYSTem:COMMunicate:LAN:DNSServer<n> <string>
:SYSTem:COMMunicate:LAN:DNSServer<n>?

Title: Domain Name System Server

Description: This command sets Domain Name System Server (DNS Server) 1 or 2. The DNS Server is used to resolve a Domain Name. This DNS Server will be contacted after any DNS Server assigned by DHCP Setting, if applicable, and will be contacted first (1) or second (2) if no DNS Name Server is assigned by DHCP Server or DHCP Feature is Disabled. To remove a DNS Server, set its value to the empty string.

Parameter(s): <string>

DNSServer Suffix Range: 1-2, Default = 1

:SYSTem:COMMunicate:LAN:FTP:STATe <0 | 1 | ON | OFF>
:SYSTem:COMMunicate:LAN:FTP:STATe?

Title: FTP Server State

Description: This command sets the system up to execute (ON) or bypass (OFF) the FTP server startup on the next instrument boot. The query returns the state of the server based on the bypass flag. 0 for bypass FTP startup, 1 for start FTP. The actual state of the FTP server is not checked for the query.

Parameter(s): <0 | 1 | ON | OFF>

:SYSTem:COMMunicate:LAN:HOSTname <string>
:SYSTem:COMMunicate:LAN:HOSTname?

Title: Local Host Name

Description: This command sets and retrieves the local host name of the instrument. A valid hostname may contain only the ASCII letters 'a' through 'z' (in a case-insensitive manner), the digits '0' through '9', and the hyphen ('-'). They cannot start/end with '-'. No other symbols, punctuation characters, or white space are permitted.

Parameter(s): <string>

:SYSTem:COMMunicate:LAN:HTTP:SECure:STATe <0 | 1 | ON | OFF>
:SYSTem:COMMunicate:LAN:HTTP:SECure:STATe?

Title: HTTPS Port State

Description: This command sets the system up to allow (ON) or bypass (OFF) the HTTPS port setup on the next instrument boot. The query returns the state of the port based on the bypass flag. 0 for bypass port setup, 1 for setup the port. The actual state of the HTTPS port is not checked for the query.

Parameter(s): <0 | 1 | ON | OFF>

:SYSTem:COMMunicate:LAN:NFS:MOUNt:LIST:REMHost?

Title: NFS Mount Remote Host

Description: This command retrieves the IP address of the remote host and the path to the remotely mounted folder, if NFS is mounted.

:SYSTem:DATe <numeric_value>,<numeric_value>,<numeric_value>
:SYSTem:DATe?

Title: System Date

Description: This command sets and queries the system's internal calendar. Changing the system date does not affect the system time zone (if time zone is available). The three parameters for this command are <year>,<month> and <day>. The query response message shall consist of three fields separated by commas: <year>,<month>,<day>. The year shall be entered as a four-digit number, including century and millennium information. This shall not be affected by a *RST command.

Parameter(s): <numeric_value>,<numeric_value>,<numeric_value>

:SYSTem:DEFault:RESet:DATA <USER|SYSTem>

Title: Reset System Files

Description: This command deletes the instrument data files as specfied in the following table: Parameter Value Description USER Deletes all user files in the instrument's internal memory including measurements, setup files, and screen shots. User-customized system files will not be deleted. SYSTem Deletes all user-customized system files including keyboard EZ names, cable lists, antenna lists, and log files.

Parameter(s): <USER|SYSTem>

:SYSTem:DEFault:RESet:FACTory

Title: Factory Default Reset

Description: This command presets parameters in all applications as well as system settings with the exception of ethernet settings (DHCP On/Off, static IP, Static Gateway, Static Subnet) to their factory default values. Last saved settings will be deleted.

:SYSTem:DEFault:RESet:MASTer

Title: Master Default Reset

Description: This command presets parameters in all applications as well as system settings with the exception of ethernet settings (DHCP On/Off, static IP, Static Gateway, Static Subnet) to default values. Last saved settings, log files, and user files will all be deleted.

:SYSTem:ERRor[:NEXT]?

Title: System Error Queue

Description: If an error occurs, the error number and message are placed in the error queue, which can be read by this query command. Errors are cleared by reading them. Error code 0, is "No error". Error codes from -100 to -199 belongs to the Command error category and sets bit 5 of the standard ESR register. Error codes from -200 to -299 belongs to the Command error category and sets bit 4 of the standard ESR register. Error codes from -400 to -499 belongs to the Query error category and sets bit 2 of the standard ESR register. Error codes from -300 to -399 and 1 to 32767 belongs to the Device-specific error and sets bit 3 of the standard ESR register. Negative error numbers (command error, execution error, device-dependent error, query error) are standard SCPI errors. Positive error numbers are device specific errors, not standard SCPI errors. The error queue is also cleared by *CLS, *RST, and when power is turned on. If more errors have occurred than can fit in the buffer, the last error stored in the queue (the most recent error) is replaced with -350, Queue overflow. No additional errors are stored until removing errors from the queue. If no errors have occurred when reading the error queue, the instrument responds with 0, No error.

:SYSTem:FIRMware:UPDate <string>,<string>

Title: Firmware Update

Description: Initiate a firmware update from the MSUS whose path is specified as parameters. If the requested firmware package is not recognized, an appropriate error will be added to the error queue. Otherwise, the instrument will verify that the package is safe to install, update to the new firmware. On MS2710XA models, the instrument will reboot disconnect all remote clients and reboot after the new firmware has been installed. The two parameters for this command are file name with relative path and mass storage device. Both parameters are case sensitive. Use "/" as a directory separator. The available mass storage devices can be retrieved by the :MMEMory:CATalog:MSUSs command. The command will fail if the file doesn't exist or the mass storage device is not present.

Parameter(s): <string>,<string>

:SYSTem:FIRMware:UPDate:REMote <string>

Title: Remote Firmware Update

Description: Initiate a remote firmware update to the package whose name is specified as a parameter. Use :SYSTem:FIRMware:UPDate:REMote:LIST? to inspect the packages that can be installed. If the requested firmware package is not recognized, an appropriate error will be added to the error. Otherwise, the instrument will download the specified firmware package, verify that the package is safe to install, update to the new firmware. On MS2710XA models, the instrument will reboot disconnect all remote clients and reboot after the new firmware has been installed. If the <STRING DATA> argument begins with (case insensitive) any of http:// https:// ftp:// Then the firmware update will be downloaded from that URL. The URL must be percent-encoded per RFC-2396 section 2.4.1.

Parameter(s): <string>

:SYSTem:FIRMware:UPDate:REMote:LATest?

Title: Check For Firmware Update

Description: Check whether the instrument firmware is at the latest version. This command will access the package list specified by SYST:FIRM:UPD:REM:SOUR and return a response of the form <string>,<number> where <string> is the name of the latest firmware package, and <number> is 1 if the latest firmware package is newer than the version of firmware currently installed (a firmware update is available), or 0 if the current instrument firmware version matches the latest version (the instrument is up to date). Clients can update the instrument to the latest firmware by passing the <string> component of the response as a parameter to the SYST:FIRM:UPD:REM command.

:SYSTem:FIRMware:UPDate:REMote:LIST?

Title: Remote Firmware Package List

Description: This command queries the instrument for a list of firmware packages that can be installed remotely. The package list will be populated from a resource file that is downloaded from a URL specified by the current value of :SYSTem:FIRMware:UPDate:REMote:SOURce. The response is ASCII response consisting of one or more comma-delimited package names. For example: 2.0.0,1.0.0 These package names enumerate the valid parameter values to the :SYSTem:FIRMware:UPDate:REMote command.

:SYSTem:FIRMware:UPDate:REMote:SOURce <string>
:SYSTem:FIRMware:UPDate:REMote:SOURce?

Title: Remote Firmware Package Source

Description: This command sets or queries the instrument's remote firmware update package list source. This source must be an http URL that is accessible to the instrument over the current network interface. The set version of this command takes a string that spells the URL to the package list file. The query version returns that string. The default value points to the repository on anritsu.com where official firmware packages for this instrument are distributed. Most users will never need to change this setting from the default. The package list file must be a JSON file that has a minimum structure. The root object must contain a "version" string (which is reserved but currently unused), a "packages" array of zero or more package objects (each at minimum have a "name", "url", "version", and "model"), and a "default" string that matches one of the package names, or is "". The version and model attributes have semantic meaning, but the name and filename (url) can be anything. An example package list file is shown below: { "version" : "0.0.1", "packages" : [{ "name" : "2.0.0 (MS2710xA)", "version" : "2.0.0", "model" : "MS2710xA", "url" : "http://files.us.anritsu.com/firmware/sh/MS2710xA_2.0.0.tar" }, { "name" : "1.0.0 (MS2710xA)", "version" : "1.0.0", "model" : "MS2710xA", "url" : "http://files.us.anritsu.com/firmware/sh/MS2710xA_1.0.0.tar" }], "default" : "1.0.0" } When the package source is set, the instrument will attempt to download the file and validate it according to the above rules before making the change permanent. If the file cannot be accessed or the file does not conform to the minimum criteria, a device specific error will be added to the error queue and the package source will remain unchanged.

Parameter(s): <string>

:SYSTem:FIRMware:VERSion?

Title: Firmware Version

Description: This command queries the device firmware version.

:SYSTem:GPS:VOLTage <numeric_value> | DEFault | MINimum | MAXimum
:SYSTem:GPS:VOLTage? [DEFault | MINimum | MAXimum]

Title: GPS Voltage

Description: Supplies either 3.3V or 5V to power the attached GPS

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 3.3

Range: 3.3 to 5

:SYSTem:LOG:ERRor?

Title: System Error Log

Description: This command retrieves the error log. The log is encrypted and can be saved to a file and sent to Anritsu Service if required.

:SYSTem:MACaddress?

Title: MAC Address

Description: This command accesses the mac address of the device.

:SYSTem:OPTions?

Title: Query Options

Description: This command retrieves the options that are currently set. The reponse is returned in "/" delimited form.

:SYSTem:OPTions:CONFig?

Title: Option Configuration

Description: This command returns a quoted string containing the configuration of currently enabled options on the instrument.

:SYSTem:OPTions:UPGRade <string>

Title: Option Upgrade

Description: This command upgrades the options of the device with a valid license key provided as a quoted string parameter. The device must be reboot immediately after this command for the installation of the new options to complete. The device must not be powered off while the command is executing. The recommended way to restart the device safely is sending the *RST command after this command. This command might report the following error code: -200 : The command failed to complete. Detailed error message will be provided in the response of :SYStem:ERRor[:NEXT]? command.

Parameter(s): <string>

:SYSTem:PRESet

Title: Preset

Description: This command presets parameters in the current application to their factory default values.

:SYSTem:SSLCertificate?

Title: SSL Certificate Information

Description: This command reports information about the SSL certificate being used by the webserver to support HTTPS connections. The information will be returned in JSON format and will consist of the following fields: 1. Start Date("notBefore"): When the certificate was generated. 2. End Date("notAfter"): When the certificate will expire. 3. Country("C"): Country of origin. 4. State("ST"): State of origin. 5. Location("L"): City of origin. 6. Organization("O"): Organization of origin. 7. Organizational Unit("OU"): Department of origin. 8. Common Name("CN"): Associated host name. All fields will be popualted into a JSON array. The resulting response will be similar to the following: [{"C":"<country>", "ST":"<state>", "L":"<city>", "O":"<organization>", "OU":"<unit>", "CN":"<host_name>, "notAfter":"<notAfter_date>", "notBefore":"<notBefore_date>"}] For the default self-signed certificate that the instrument will automatically generate when no user certificate is available, the Organization field will be set to "Anritsu Default SSL Certificate". An example of the certificate data is shown below for the default self-signed certificate: [{"C": "US","CN": "anritsu.com","L": "Morgan Hill","O": "Anritsu Default SSL Certificate","OU": "Engineering","ST": "California", "notAfter": "Oct 26 19:05:26 2917 GMT","notBefore": "Jun 1 19:05:26 2018 GMT"}]

:SYSTem:TEMPerature?

Title: Get System Temperature

Description: This command returns the device temperature in Celcius.

:SYSTem:TIMe <numeric_value>,<numeric_value>,<numeric_value>
:SYSTem:TIMe?

Title: System Time

Description: This command sets and queries the system's internal clock. Changing the system time does not affect the system time zone (if time zone is available). The three parameters for this command are <hour>,<minute> and <second>. The query response message shall consist of three fields separated by commas: <hour>,<minute>,<second>.

Parameter(s): <numeric_value>,<numeric_value>,<numeric_value>

:SYSTem:UNIT:NAMe <string>
:SYSTem:UNIT:NAMe?

Title: System Unit Name

Description: This command sets/queries the unit name of the current system.The name of the unit must not be greater than 45 ASCII characters

Parameter(s): <string>

:TEST:SELFtest?

Title: Self Test

Description: Perform a self-test and return the results. The response is formatted as a JSON (http://json.org/) array of name,value pair result objects. Some result objects also include a 'status' property that will be either 'pass' or 'fail' based on whether the criteria for that test was met. For tests of voltages, the test passes if the measured voltage is within 10% of the expected voltage.

6-8 SPA Commands

:ABORt

Title: Abort

Description: Resets the trigger system. This has the effect of aborting the sweep or any measurement that is currently in progress. Additionally, any pending operation flags that were set by initiation of the trigger system will be set to false. If :INITiate:CONTinuous is OFF (i.e. the instrument is in single sweep mode), send the command :INITiate[:IMMediate] to trigger the next sweep. If :INITiate:CONTinuous is ON (i.e. the instrument is in continuous sweep mode) a new sweep will start immediately.

6-9 :CALCulate Subsystem

The commands in this subsystem process data that has been collected via the `CALCulate` subsystem.

:CALCulate<n>:LIMit<n>:COMMent <string>
:CALCulate<n>:LIMit<n>:COMMent?

Title: Limit Comment

Description: Associates a user-defined comment with each limit. The set version of this command takes a single parameter that is a string containing the desired comment. The query version returns the comment that is set. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <string>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:CONTrol:MODE <ABSolute|RELative>
:CALCulate<n>:LIMit<n>:CONTrol:MODE?

Title: Limit Control Mode

Description: Choose either ABSolute or RELative limit. In ABSolute mode, the control value of the limit line is defined by absolute physical values (Hz). In RELative mode, the control value of the limit line is relative to the center frequency (Hz). If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <ABSolute|RELative>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:CONTrol:SHIFt <numeric_value> {HZ | KHZ | MHZ | GHZ}

Title: Limit Control Shift

Description: Move a limit line along the control axis. This command changes the value of :CALCulate<n>:LIMit<k>:CONTrol[:DATA]. Issuing this command multiple times will change the limits each time. For example, sending CALC:LIM1:CONT:SHIFT 1 Hz CALC:LIM1:CONT:SHIFT 1 Hz CALC:LIM1:CONT:SHIFT 1 Hz CALC:LIM1:CONT:SHIFT 1 Hz CALC:LIM1:CONT:SHIFT 1 Hz will shift the control axis by 5 Hz If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ}

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:COPY <numeric_value>

Title: Limit Copy

Description: Copies a limit line eg: CALC:LIM1:COPY 2 Copies limit 1 to line 2 If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <numeric_value>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:DELete

Title: Limit Delete

Description: Deletes a limit line If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:FAIL?

Title: Limit Fail

Description: This command queries the result of a limit check. All traces that have had checking enabled (via CALC:TRAC:CHEC) will be evaluated against the upper and lower data of the specified limit, unless the limit STATe is OFF (in which case this command will always return 0), or the upper or lower STATe is OFF (in which case only the data with STATe ON will be checked). If the sweep has not completed yet, the partial trace will be evaluated. If INITiate:CONTinuous is ON, a snapshot of the trace at the time this command was received will be evaluated against the limit. This command returns 1 if any of the checked traces violate the limit, otherwise it returns 0. When a limit is evaluated, there are some rules that are followed if the cardinality of the limits control, upper, and lower data are not equal. If there are fewer control data points than upper or lower data points, then only the first n upper or lower points will be evaluated, where n is the number of control points. If there are fewer upper or lower points than control points, then the effective number of upper or lower points will be increased to the number of control points, with the 'extrapolated' points having a value equal to the last upper or lower point. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:LOWer:MODE <ABSolute|RELative>
:CALCulate<n>:LIMit<n>:LOWer:MODE?

Title: Limit Lower Mode

Description: Choose either ABSolute or RELative limit. In ABSolute mode, the control value of the limit line is defined by absolute physical values (dBm). In RELative mode, the control value of the limit line is relative to the reference level (dB). If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <ABSolute|RELative>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:LOWer:SHIFt <numeric_value> {DB}

Title: Lower Limit Shift

Description: Move the lower limit up or down by a relative amplitude. This command changes the value of :CALCulate<n>:LIMit<k>:LOWer[:DATA]. Issuing this command multiple times will change the limits each time. For example, sending CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB will shift the lower limit by 5 dB If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {DB}

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:LOWer:STATe <0 | 1 | ON | OFF>
:CALCulate<n>:LIMit<n>:LOWer:STATe?

Title: Lower Limit State

Description: Turns ON or OFF the lower limit. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0 | 1 | ON | OFF>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:NAME <string>
:CALCulate<n>:LIMit<n>:NAME?

Title: Limit Name

Description: Associates a user-defined name with each limit. The set version of this command takes a single parameter that is a string containing the desired limit name. The query version returns the name that is set. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <string>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:STATe <0 | 1 | ON | OFF>
:CALCulate<n>:LIMit<n>:STATe?

Title: Limit State

Description: Turns the limit check for a specific limit ON or OFF. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0 | 1 | ON | OFF>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:TRACe<n>:CHECk <0 | 1 | ON | OFF>
:CALCulate<n>:LIMit<n>:TRACe<n>:CHECk?

Title: Limit Trace Check

Description: This command turns the limit check for a specific trace on and off. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0 | 1 | ON | OFF>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

TRACe Suffix Range: 1-6, Default = 1

:CALCulate<n>:LIMit<n>:UPPer:MODE <ABSolute|RELative>
:CALCulate<n>:LIMit<n>:UPPer:MODE?

Title: Upper Limit Mode

Description: Choose either ABSolute or RELative limit. In ABSolute mode, the control value of the limit line is defined by absolute physical values (dBm). In RELative mode, the control value of the limit line is relative to the reference level (dB). If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <ABSolute|RELative>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:UPPer:SHIFt <numeric_value> {DB}

Title: Upper Limit Shift

Description: Move the upper limit up or down by a relative amplitude. This command changes the value of :CALCulate<n>:LIMit<k>:UPPer[:DATA]. Issuing this command multiple times will change the limits each time. For example, sending CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB will shift the upper limit by 5 dB If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {DB}

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>:UPPer:STATe <0 | 1 | ON | OFF>
:CALCulate<n>:LIMit<n>:UPPer:STATe?

Title: Upper Limit State

Description: Turns ON or OFF the upper limit. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0 | 1 | ON | OFF>

CALCulate Suffix Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit:ACTive?

Title: Limit Active

Description: Queries the numbers of all active limit lines in ascending order.This command returns a empty string if no limits are active.

CALCulate Suffix Range: 1, Default = 1

:CALCulate:ACPower:LIMit:ADJacent:ABSolute <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:ACPower:LIMit:ADJacent:ABSolute? [DEFault | MINimum | MAXimum]

Title: Adjacent Channel Power Adjacent Absolute Limit

Description: Sets and queries the amplitude of absolute limit for acpr adjacent power.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10 dBm

Default Unit: dBm

Range: -200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ADJacent:LOWer:FAIL?

Title: Acpr Limit Adjacent Lower Fail

Description: This command queries the result of a limit check on lower adjacent channel power

:CALCulate:ACPower:LIMit:ADJacent:RELative <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:ACPower:LIMit:ADJacent:RELative? [DEFault | MINimum | MAXimum]

Title: Adjacent Channel Power Adjacent Relative Limit

Description: Sets and queries the amplitude of relative limit for acpr adjacent power. See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10 dBm

Default Unit: dBm

Range: -200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ADJacent:UPPer:FAIL?

Title: Acpr Limit Adjacent Upper Fail

Description: This command queries the result of a limit check on upper adjacent channel power

:CALCulate:ACPower:LIMit:ALTernate:ABSolute <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:ACPower:LIMit:ALTernate:ABSolute? [DEFault | MINimum | MAXimum]

Title: Adjacent Channel Power Alternate Absolute Limit

Description: Sets and queries the amplitude of absolute limit for acpr alternate power.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10 dBm

Default Unit: dBm

Range: -200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ALTernate:LOWer:FAIL?

Title: Acpr Limit Alternate Lower Fail

Description: This command queries the result of a limit check on lower alternate channel power

:CALCulate:ACPower:LIMit:ALTernate:RELative <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:ACPower:LIMit:ALTernate:RELative? [DEFault | MINimum | MAXimum]

Title: Adjacent Channel Power Alternate Relative Limit

Description: Sets and queries the amplitude of relative limit for acpr alternate power.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10 dBm

Default Unit: dBm

Range: -200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ALTernate:UPPer:FAIL?

Title: Acpr Limit Alternate Upper Fail

Description: This command queries the result of a limit check on upper alternate channel power

:CALCulate:ACPower:LIMit:FAIL?

Title: Acpr Limit Fail

Description: This command queries the result of a limit check on adjacent channel power ratio

:CALCulate:ACPower:LIMit:MAIN <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:ACPower:LIMit:MAIN? [DEFault | MINimum | MAXimum]

Title: Adjacent Channel Power Main Limit

Description: Sets and queries the amplitude of limit for main power.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10 dBm

Default Unit: dBm

Range: -200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:MODE <ABSolute|RELative>
:CALCulate:ACPower:LIMit:MODE?

Title: Adjacent Channel Power Limit Mode

Description: Sets the acpr limit mode to be absolute or relative

Parameter(s): <ABSolute|RELative>

Query Return: ABS|REL

Default Value: ABSolute

:CALCulate:ACPower:LIMit:STATe <0 | 1 | ON | OFF>
:CALCulate:ACPower:LIMit:STATe?

Title: Adjacent Channel Power Limit State

Description: Sets the acpr limit state to be ON or OFF

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:CALCulate:CHPower:LIMit <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:CHPower:LIMit? [DEFault | MINimum | MAXimum]

Title: Channel Power Limit

Description: Sets and queries the amplitude of limit on channel power.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10 dBm

Default Unit: dBm

Range: -200 dBm to 200 dBm

:CALCulate:CHPower:LIMit:FAIL?

Title: Channel Power Limit Fail

Description: This command queries the result of a limit check on channel power

:CALCulate:CHPower:LIMit:PSDensity <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:CHPower:LIMit:PSDensity? [DEFault | MINimum | MAXimum]

Title: Channel Power Spectral Density Limit

Description: Sets and queries the amplitude of limit on channel power spectral density. See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10 dBm

Default Unit: dBm

Range: -200 dBm to 200 dBm

:CALCulate:CHPower:LIMit:PSDensity:STATe <0 | 1 | ON| OFF>
:CALCulate:CHPower:LIMit:PSDensity:STATe?

Title: Channel Power Spectral Density Limit State

Description: Sets and queries the state of limit on channel power spectral density. The set form of this command sets the limit state to be ON or OFF

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:CALCulate:CHPower:LIMit:PSD:FAIL?

Title: Power Spectral Density Limit Fail

Description: This command queries the result of a limit check on channel power spectral density

:CALCulate:CHPower:LIMit:STATe <0 | 1 | ON | OFF>
:CALCulate:CHPower:LIMit:STATe?

Title: Channel Power Limit State

Description: Sets and queries the state of limit on channel power. The set form of this command sets the limit state to be ON or OFF

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:CALCulate:LIMit<n>:CONTrol[:DATA] <numeric_value> {HZ | KHZ | MHZ | GHZ}, {<numeric_value> {HZ | KHZ | MHZ | GHZ}}, ...
:CALCulate:LIMit<n>:CONTrol[:DATA]?

Title: Limit Control Data

Description: This command sets or queries the control data (X-axis values) for the specified limit. The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON). This command takes a list of one or more frequency values as parameters. For example, CALC:LIM1:CONT:DATA 1 MHz, 2MHz, 3MHz Note that it is permitted to set one or more invalid 'placeholder' values of Not-A-Number (NAN). The placeholder value for NAN is 9.91e37. If a control data point contains a value of 9.91e37, limit line interpolation from the previous data point, and to the next data point, will not occur. This is useful for defining discontiguous (or segmented) limit lines within a single limit. For example, to define a limit line of two discontiguous segments, one from 1 MHz to 10 MHz, and another from 20 MHz to 30 MHz, send the following control data: CALC:LIM1:CONT:DATA 1MHz, 10MHz, 9.91e37, 20MHz, 30MHz Note that the upper (or lower) data, if used, should contain the same amount of points as the control data (see CALC:LIM:FAIL? for details on what happens when this is not true). Thus, when using placeholders in control data, it is recommended that placeholders are also used in the upper (or lower) data. For example, CALC:LIM1:CONT:UPP 0dBm, 10dBm, 9.91e37, 10dBm, 0dBm The exact value for the middle point does not matter, as interpolation will always be skipped due to the control data containing NAN, but using NAN for the corresponding upper (or lower) data value will make it easier to remember that the point is a placeholder.

Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ}, {<numeric_value> {HZ | KHZ | MHZ | GHZ}}, ...

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>:ENVelope:UPDate:Y

Title: Update Limit Envelope Amplitude

Description: This command updates the amplitude of the upper and lower limits without changing the frequencies of the inflection points.

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>:LOWer[:DATA] <numeric_value> {<amplitude_units>}, {<numeric_value> {<amplitude_units>}}, ...
:CALCulate:LIMit<n>:LOWer[:DATA]?

Title: Lower Limit Data

Description: This command sets or queries the lower limit data (Y-axis values) for the specified limit. The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON). This command takes a list of one or more amplitude values as parameters. For example, CALC:LIM1:LOW:DATA 1 dBm, 2dBm, 3 dBm Note that it is permitted to set one or more data values of +/- infinity. The placeholder value for +/- infinity is +/-9.9e37. If a lower data point contains a value of +/-9.9e37, the amplitude at that point will be treated as if it were +/-inifinity (i.e. the lower limit will either always fail or always pass at that point). It is also permitted to set one or more invalid 'placeholder' values of Not-A-Number (NAN). This is useful for defining discontiguous (or segmented) limit lines within a single limit. For details, and an example, of using placeholder values, see CALC:LIM:CONT:DATA.

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {<amplitude_units>}, {<numeric_value> {<amplitude_units>}}, ...

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>:LOWer:ENVelope:CREate

Title: Create Lower Limit Envelope

Description: This command is used to create an Lower limit envelope on the selected trace.

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>:LOWer[:TRACe]:POINts?

Title: Lower Limit Points

Description: This command queries the upper limit trace points (Y-axis values) for the specified limit. This differs from the limit data in that a value is returned for each point in the trace to indicate the values that are being used to evaluate limit pass/fail status. The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1. If a limit of the specified number does not exist, an empty list will be returned.

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>:UPPer[:DATA] <numeric_value> {<amplitude_units>}, {<numeric_value> {<amplitude_units>}}, ...
:CALCulate:LIMit<n>:UPPer[:DATA]?

Title: Upper Limit Data

Description: This command sets or queries the upper limit data (Y-axis values) for the specified limit. The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1. If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON). This command takes a list of one or more amplitude values as parameters. For example, CALC:LIM1:UPP:DATA 1 dBm, 2dBm, 3 dBm Note that it is permitted to set one or more data values of +/- infinity. The placeholder value for +/- infinity is +/-9.9e37. If an upper data point contains a value of +/-9.9e37, the amplitude at that point will be treated as if it were +/-infinity (i.e. the upper limit will either always pass or always fail at that point). It is also permitted to set one or more invalid 'placeholder' values of Not-A-Number (NAN). This is useful for defining discontiguous (or segmented) limit lines within a single limit. For details, and an example, of using placeholder values, see CALC:LIM:CONT:DATA.

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {<amplitude_units>}, {<numeric_value> {<amplitude_units>}}, ...

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>:UPPer:ENVelope:CREate

Title: Create Upper Limit Envelope

Description: This command is used to create an Upper limit envelope on the selected trace.

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>:UPPer[:TRACe]:POINts?

Title: Upper Limit Points

Description: This command queries the upper limit trace points (Y-axis values) for the specified limit. This differs from the limit data in that a value is returned for each point in the trace to indicate the values that are being used to evaluate limit pass/fail status. The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1. If a limit of the specified number does not exist, an empty list will be returned.

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit:ALARm <0 | 1 | ON | OFF>
:CALCulate:LIMit:ALARm?

Title: Limit Alarm

Description: This command enables/disables the AAE notification for limit failures.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:CALCulate:LIMit:ENVelope:OFFSet <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:LIMit:ENVelope:OFFSet? [DEFault | MINimum | MAXimum]

Title: Limit Envelope Offset

Description: This command sets/gets the limit envelope offset. This defines how far away from the measured signal indicated the limit envelope is placed. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 3 dBm

Default Unit: dBm

Range: -100 dBm to 100 dBm

:CALCulate:LIMit:ENVelope:POINt <numeric_value> | DEFault | MINimum | MAXimum
:CALCulate:LIMit:ENVelope:POINt? [DEFault | MINimum | MAXimum]

Title: Number of Limit Envelope Points

Description: This command sets the number of inflection point for the limit envelope.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 20

Range: 2 to 41

:CALCulate:LIMit:ENVelope:SHAPe <SQUare|SLOPe>
:CALCulate:LIMit:ENVelope:SHAPe?

Title: Limit Envelope Shape

Description: This command sets/gets the currently active limit envelope shape.

Parameter(s): <SQUare|SLOPe>

Query Return: SQU|SLOP

Default Value: SQUare

:CALCulate:MARKer<n>:FUNCtion <OFF|NOISe>
:CALCulate:MARKer<n>:FUNCtion?

Title: Marker Function

Description: Select the marker function to perform post-processing operation. The default/OFF function performs pass through operation.

Parameter(s): <OFF|NOISe>

Query Return: OFF|NOIS

MARKer Suffix Range: 1-12, Default = 1

Default Value: OFF

:CALCulate:MARKer<n>:MAXimum

Title: Maker Move To Highest Peak

Description: Moves the marker X value to the point in the marker's assigned trace that has the highest peak.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>:MAXimum:LEFT

Title: Marker Move To Left Peak

Description: Moves the marker X value to the point in the marker's assigned trace that is the next highest peak to the LEFT of the current X position of the marker.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>:MAXimum:NEXT

Title: Marker Move To Next Peak

Description: Moves the marker X value to the point in the marker's assigned trace that is the next highest peak.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>:MAXimum:RIGHt

Title: Marker Move To Right Peak

Description: Moves the marker X value to the point in the marker's assigned trace that is the next highest peak to the RIGHT of the current X position of the marker.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>:MODE <POSition|DELTa|FIXed|OFF>
:CALCulate:MARKer<n>:MODE?

Title: Marker Mode

Description: Select the marker mode. POSition mode is a normal marker mode. DELTa mode is marker report difference relative to another marker. FIXed mode is a marker who's Y value is fixed at the last measured value before it is set to FIXed. OFF mode is disable the marker.

Parameter(s): <POSition | DELTa | FIXed | OFF>

Query Return: POS | DELT | FIX | OFF

MARKer Suffix Range: 1-12, Default = 1

Default Value: OFF

:CALCulate:MARKer<n>:MOVE:LEFT

Title: Marker Move To Left

Description: Moves the marker X value to the next display point to the LEFT.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>:MOVE:RIGHt

Title: Marker Move To Right

Description: Moves the marker X value to the next display point to the RIGHT.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>:REFerence <numeric_value>
:CALCulate:MARKer<n>:REFerence?

Title: Marker Reference

Description: Sets the reference marker for the specified delta marker. This setting will be applied only if the marker mode set to DELTa.

Parameter(s): <numeric_value>

Query Return: Numeric

MARKer Suffix Range: 1-12, Default = 1

Default Value: 0

Range: 0 to 12

:CALCulate:MARKer<n>[:SET]:CENTer

Title: Marker Set Center

Description: Sets the center frequency of the instrument to the current X value of the marker.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>[:SET]:RLEVel

Title: Marker Set Reference Level

Description: Sets the reference level of the instrument to the current Y value of the marker.

MARKer Suffix Range: 1-12, Default = 1

:CALCulate:MARKer<n>:TRACe <numeric_value>
:CALCulate:MARKer<n>:TRACe?

Title: Marker Trace

Description: Changes the trace to which the marker is currently attached.

Parameter(s): <numeric_value>

Query Return: Numeric

MARKer Suffix Range: 1-12, Default = 1

Default Value: 1

Range: 1 to 6

:CALCulate:MARKer<n>:X <numeric_value> {HZ | KHZ | MHZ | GHZ}
:CALCulate:MARKer<n>:X?

Title: Marker Position

Description: Sets the marker frequency.

Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ}

Query Return: Numeric (Hz)

MARKer Suffix Range: 1-12, Default = 1

Default Value: 200000000000 Hz

Default Unit: Hz

Range: -400000000000 Hz to 300000000000 Hz

:CALCulate:MARKer<n>:Y <numeric_value> {<amplitude_units>}
:CALCulate:MARKer<n>:Y?

Title: Marker Value

Description: Set/Get the marker Y value. The user defined Y maker value will be applied only if the marker is in Fixed mode.

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {<amplitude_units>}

Query Return: Numeric (<amplitude_units>)

MARKer Suffix Range: 1-12, Default = 1

Default Value: 10 dBm

Default Unit: dBm

Range: -250 dBm to 130 dBm

:CALCulate:MARKer:AOFF

Title: Marker All Off

Description: Turns all markers off.

:CALCulate:MARKer[:DATA]:ALL?

Title: All Marker Data

Description: Return X value and Y value of all markers. The response format is (marker1.x, marker1.y), (marker2.x, marker2.y), ... (markern.x, markern.y).

:CALCulate:MARKer:PEAK:EXCursion <numeric_value> {DB} | DEFault | MINimum | MAXimum
:CALCulate:MARKer:PEAK:EXCursion? [DEFault | MINimum | MAXimum]

Title: Marker Excursion

Description: Sets the excursion for a marker. The excursion is the vertical distance from the peak to the next highest valley which must be exceeded for a peak to be considered a peak in marker max commands.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (dB)

Set Command Parameter(s): <numeric_value> {DB} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 dB

Default Unit: dB

Range: 0 dB to 200 dB

:CALCulate:MARKer:PEAK:EXCursion:STATe <0 | 1 | ON | OFF>
:CALCulate:MARKer:PEAK:EXCursion:STATe?

Title: Marker Excursion State

Description: Turn on/off excursion checking for marker max commands.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:CALCulate:MARKer:PEAK:THReshold <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:CALCulate:MARKer:PEAK:THReshold? [DEFault | MINimum | MAXimum]

Title: Marker Threshold

Description: Sets the threshold level for a marker. The threshold is the level that a peak must exceed to be considered a peak in marker max commands.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 dBm

Default Unit: dBm

Range: -200 dBm to 100 dBm

:CALCulate:MARKer:PEAK:THReshold:STATe <0 | 1 | ON | OFF>
:CALCulate:MARKer:PEAK:THReshold:STATe?

Title: Marker Threshold State

Description: Turn on/off threshold checking for marker max commands.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:CALCulate:OBW:LIMit <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
:CALCulate:OBW:LIMit? [DEFault | MINimum | MAXimum]

Title: OBW Limit

Description: Sets and queries the frequency limit on occupied bandwidth power.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10000 Hz

Default Unit: Hz

Range: 1000 Hz to 300000000000 Hz

:CALCulate:OBW:LIMit:FAIL?

Title: OBW Limit Fail

Description: This command queries the result of a limit check on occupied bandwidth power

:CALCulate:OBW:LIMit:STATe <0 | 1 | ON | OFF>
:CALCulate:OBW:LIMit:STATe?

Title: OBW Power Limit State

Description: Sets and queries the state of limit on occupied bandwidth power. The set form of this command sets the limit state to be ON or OFF

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:CALCulate:PEAK:COUNt <numeric_value> | DEFault | MINimum | MAXimum
:CALCulate:PEAK:COUNt? [DEFault | MINimum | MAXimum]

Title: Peak Count

Description: The desired number of peaks to be reported by FETC:PEAK? query.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 1

Range: 1 to 6

:CALCulate:PEAK:THReshold <numeric_value> {<amplitude_units>}
:CALCulate:PEAK:THReshold?

Title: Peak Threshold Level

Description: Sets the threshold level which peak powers must exceed to be reported by FETC:PEAK? query.

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {<amplitude_units>}

Query Return: Numeric (<amplitude_units>)

Default Value: 0 dBm

Default Unit: dBm

Range: -150 dBm to 30 dBm

:CALCulate:PEAK:THReshold:STATe <0 | 1 | ON | OFF>
:CALCulate:PEAK:THReshold:STATe?

Title: Peak Threshold State

Description: Turn ON|OFF the threshold that peak powers must exceed to be reported by PEAKS? query.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

6-10 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement. It sets the instrument to single sweep mode, waiting for an `:INITiate` command. It will not initiate the taking of a measurement. Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

:CONFigure:ACPower

Title: Configure Adjacent Channel Power Ratio

Description: Configures the default adjacent channel power ratio measurement. Disables any other active one-button measurements, including channel power, occupied bandwidth, AM/FM demodulation and C/I. Sets the main channel bandwidth equal to the span. Sets the adjacent channel bandwidth and channel spacing equal to the main channel bandwidth. Sets the detection method to RMS. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe]:ACPower commands before initiating a sweep.

:CONFigure:CHPower

Title: Configure Channel Power

Description: Configures the default channel power measurement.Disables any other active one-button measurements, including ACPR, occupied bandwidth, AM/FM demodulation and C/I. Sets the integration bandwidth equal to the span. Sets the detection method to RMS. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe]:CHPower commands before initiating a sweep. Note that this measurement is not valid in zero span.

:CONFigure:OBWidth

Title: Configure Occupied Bandwidth

Description: Configures the default occupied bandwidth measurement. Disables any other active one-button measurements, including channel power, ACPR, AM/FM demodulation and C/I. Sets the method to %. Sets the % of power to 99%. Sets the instrument to single sweep mode (:INITiate:CONTinuous: OFF). Measurement settings can be modified by using the [:SENSe]:OBWidth commands before initiating a sweep. Note that this measurement is not valid in zero span.

:CPRI:PORT<n>:SFP?
<WLEN|BRAT|VNAM|STAT|PNUM|REV|SNUM|PDAT|LCOD|TCOMP|SMLEN|MM50LEN|MM62P5LEN|CLEN|TXPWR|RXPWR|ALL>

Title: CPRI Port SFP Info

Description: Get information for SFP ports connected to the board. The numeric suffix on PORT specifies which sfp port number to query. If the suffix is omitted, the command will refer to sfp port 1 The command takes below query parameters:
WLEN | BRAT | VNAM | STAT | PNUM | REV | SNUM | PDAT | LCOD | TCOMP | SMLEN | MM50LEN | MM62P5LEN | CLEN | TXPWR | RXPWR | ALL WLEN return wavelength BRAT return the bit rate VNAM return the vendor name STAT return the status PNUM return the product number REV return the revision SNUM return the serial number PDAT return the product date LCOD return the lot code TCOMP return transceiver compliance SMLEN return 9 um length MM50LEN return 50 um length MM62P5LEN return 62.5 um length CLEN return copper lenth TXPWR return transmit power.

RXPWR return receive power ALL return all the above parameters as key=value comma separated values if any of the above parameter has invalid value, N/A is returned for its value Note: if a sfp is compliant with multiple transceivers then the value is separated by "|" eg:TCOMP=10G Base-LR | OC48/STM 16 IR where the sfp is compliant with 10G Base-LR and OC48/STM 16 IR eg: CPRI:PORT1:SFP? ALL BRAT=10300 Mbps,CLEN=N/A,LCOD= ,MM50LEN=N/A,MM62P5LEN=N/A, PDAT=150822,PNUM=TR-PX13L-N00 ,REV=1B , RXPWR=-13.7779 dBm,SMLEN=100 km,SNUM=INFAL0180899 , TCOMP=10G Base-LR,TXPWR=-2.53132 dBm,VNAM=INNOLIGHT , WLEN=1310 nm,STAT=1

Parameter(s):

<WLEN | BRAT | VNAM | STAT | PNUM | REV | SNUM | PDAT | LCOD | TCOMP | SMLEN | MM50LEN | MM62P5LEN | CLEN | TXPWR | RXPWR | ALL>

PORT Suffix Range: 1-2, Default = 1

:DIAGnostic Subsystem

:DIAGnostic:CPRI:PORT<n>:ALARms?

Title: CPRI Antenna Container

Description: Returns the CPRI Layer 2 Alarms status for the specified SFP port as a decimal integer representing the bitwise-OR of one or more status bits: Bit Meaning 0 SLOS (Optical signal loss) 1 LOS (Loss of Signal) 2 LOF (Loss of Frame) 3 LSS (Loss of Signal Synchronization) 4 RLOS (Remote Loss of Signal) 5 RLOF (Remote Loss of Fiber) 6 RAI (Remote Alarm Indication) 7 SDI (SAP Defect Indication) 8 Reset Request 9-30 Not Implemented 31 Active (SFP connected) Alarm statuses are only meaningful when an SFP is connected. When an SFP is connected, the Active bit will be set. If this bit is 0 (inactive), the values of the other bits are undefined. When reading the alarm status, we recommend checking the Active bit first to determine if it makes sense to read the other bits.

PORT Suffix Range: 1-2, Default = 1

:DIAGnostic:CPRI:VERSion:CPLD?

Title: CPRI CPLD Version

Description: Retrieve the CPLD version. The response is returned as a string of the form X.YZ, for example, 1.00.

:DIAGnostic:CPRI:VERSion:FPGA?

Title: CPRI FPGA Version

Description: Retrieve the CPRI FPGA version number. The CPRI FPGA implements the measurement capability to convert CPRI I/Q data into a spectrum. The response is returned as a string of the form X.YZ, for example, 1.00.

:DIAGnostic:CPRI:VERSion:FPGA:CORe?

Title: Core (CPRI) FPGA Version

Description: Retrieve the Core (CPRI) FPGA version number. The Core FPGA implements logic to decode the CPRI protocol. The response is returned as a string of the form X.YZ, for example, 1.00.

:DIAGnostic:REFerence:DAC <numeric_value> | DEFault | MINimum | MAXimum
:DIAGnostic:REFerence:DAC? [DEFault | MINimum | MAXimum]

Title: Dac Control

Description: Set the value of the reference DAC for MS2760A and MA24507A models.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 39321

Range: 0 to 65535

:DIAGnostic:SWEep:TIME?

Title: Measured Sweep Time

Description: This command queries the measured sweep time, in number of milliseconds. This command will return "nan" if no measured sweep time is available, which happens if the sweep was reset and the instrument has not yet swept enough to measure a full sweep.

6-11 :DISPlay Subsystem

This subsystem provides commands that modify the display of data for the user. They do not modify the way in which data are returned to the controller.

:DISPlay:POINtcount <numeric_value> | DEFault | MINimum | MAXimum
:DISPlay:POINtcount? [DEFault | MINimum | MAXimum]

Title: Display Point Count

Description: Changes the number of display points the instrument currently measures. Increasing the number of display points can improve the resolution of measurements but will also increase sweep time.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 501

Range: 10 to 4001

:DISPlay:VIEW <NORMal|SPECtrogram>
:DISPlay:VIEW?

Title: Display View

Description: The display view command can be used to enable/disable spectrogram features.

Parameter(s): <NORMal|SPECtrogram>

Query Return: NORM|SPEC

Default Value: NORMal

:DISPlay[:WINDow]:SWEep[:CURRent]:POINt?

Title: Current Display Point

Description: This command returns the newest display point index of current sweep. This index can be used to calculate the current sweep progress.

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <numeric_value> | DEFault | MINimum | MAXimum
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision? [DEFault | MINimum | MAXimum]

Title: Scale Per Division

Description: Set or query the scale per division setting of trace graph. This command doesn't change any behavior in the backend but will be included in save/recall operations.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10

Range: 1 to 15

:DISPlay[:WINDow]:TRACe:Y:SCALe:RLEVel <numeric_value> {<amplitude_units>}
:DISPlay[:WINDow]:TRACe:Y:SCALe:RLEVel?

Title: Reference Level

Description: Sets the reference level amplitude value for the y-axis. This value is the display reference level, which means it has the reference level offset applied. It also means that a change to the reference level offset will change this setting (though the actual, unadjusted reference level will stay the same). Note that this may cause a change in attenuation if the automatic input attenuation coupling is enabled. For the purpose of coupling, the actual reference level (without the offset applied) is used, though this command will always reflect the display value. For example, suppose a starting reference level offset of 0 dB and a reference level of 10 dBm. If the offset is set to 20 dB, the display reference level will be set to 10 dBm - 20 dB = -10 dBm; no attenuation change will occur. Likewise, if the starting reference level offset is 20 dB and the (display) reference level is set to 0 dBm, the display reference level will remain at 0 dBm, though the (actual) reference level value used in auto attenuation coupling is 0 dBm + 20 dB = 20 dBm. To obtain the actual reference level, either add in the reference level offset, or temporarily set the offset to 0 (in which case the display reference level will reflect the actual one).

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {<amplitude_units>}

Query Return: Numeric (<amplitude_units>)

Default Value: 10 dBm

Default Unit: dBm

Range: -150 dBm to 30 dBm

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel:AUTO[:IMMediate] <numeric_value> {DB}

Title: Automatic Reference Level

Description: This command causes the reference level to immediately be set to an automatically computed value that best displays the particular data. The reference level is set to a specified dB above the selected trace max value. This command is semantically equivalent to :DISPlay[:WINDow]:TRACe[:SCALe]:RLEVel <amplitude> with the computed value for amplitude.

See UNIT:POWer to query or set the current amplitude units.

Parameter(s): <numeric_value> {DB}

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet <numeric_value> {DB} | DEFault | MINimum | MAXimum
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet? [DEFault | MINimum | MAXimum]

Title: Reference Level Offset

Description: Sets the reference level offset value for the y-axis. This offset is used for display purposes only, and does not affect the actual reference level used for auto attenuation coupling, or any other settings that depend on reference level. See DISP:WIND:TRAC:Y:SCAL:RLEV for details on the interaction between reference level offset and display reference level.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (dB)

Set Command Parameter(s): <numeric_value> {DB} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 dB

Default Unit: dB

Range: -99.9 dB to 99.9 dB

6-12 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ or MEASure` query commands.

`:FETCh:ACPower?`

Title: Fetch Adjacent Channel Power Ratio

Description: Returns the most recent adjacent channel power ratio measurement results. If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a *RST immediately before the :FETCh? or if a measurement parameter was changed without an :INITiate Data is returned as 9 comma-separated values: main channel power, absolute lower adjacent channel power, absolute upper adjacent channel power, absolute lower alternate channel power,absolute upper alternate channel power, relative lower adjacent channel power, relative upper adjacent channel power, relative lower alternate channel power,relative upper alternate channel power. If the measurement is not enabled with [:SENSe]:ACPower:STATe then, the instrument will indicate error -400 and return the string "nan,nan,nan,nan,nan,nan,nan,nan,nan"

`:FETCh:AMPLitude? <numeric_value> {HZ | KHZ | MHZ | GHZ}`

Title: Fetch Amplitude

Description: Returns the amplitude at the given frequency. The command does not wait for the sweep to complete. If the trace data at the requested frequency is invalid (or out of span) then NAN is returned and error code -230 is indicated.

Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ}

`:FETCh:CHPower?`

Title: Fetch Channel Power and Density

Description: This command returns the most recent channel power measurement results: channel power and channel power density. If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a *RST immediately before the :FETCh? or if a measurement parameter was changed without an :INITiate.Data is returned as 2 comma-separated values: channel power, channel power density.If the measurement is not enabled with [:SENSe]:CHPower:STATe then, the instrument will indicate error -400 and return the string "nan,nan"

`:FETCh:CHPower:CHPower?`

Title: Fetch Channel Power and Density

Description: Returns the most recent channel power measurement result. It returns only the channel power, not the channel power density. Use :FETCh:CHPower? to get both channel power and channel power density.If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230.This could occur if there was a *RST immediately before the :FETCh? or if a measurement parameter was changed without an :INITiate.If the measurement is not enabled with [:SENSe]:CHPower:STATe then, the instrument will indicate error -400 and return the string "nan,nan"

:FETCh:CHPower:DENSity?

Title: Fetch Channel Power Density

Description: Returns the most recent channel power density measurement result. It returns only the channel power density, not the channel power. Use :FETCh:CHPower? to get both channel power and channel power density. If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230.This could occur if there was a *RST immediately before the :FETCh? or if a measurement parameter was changed without an :INITiate.If the measurement is not enabled with [:SENSe]:CHPower:STATe then, the instrument will indicate error -400 and return the string "nan,nan"

:FETCh:OBWidth<n>?

Title: Fetch Occupied Bandwidth

Description: Returns a different set of measurement information depending on the suffix. The default suffix of 1 will return the most recent occupied bandwidth measurement results: occupied bandwidth, percent of power and dB down. One of either percent of power or dB down is measured and the other is set. That is determined by the value set using [:SENSe]:OBWidth:METHod. If the measurement is not enabled with :SENSe:OBWidth:STATe then, the instrument will indicate error -400 and return the string "nan,nan,nan". Using suffix 2 will return the most recent channel power, x dB bandwidth, percent bandwidth, and transmit frequency error. The channel power and occupied bandwidth measurements will be calculated regardless of CHP:STAT and OBW:STAT settings. For both suffixes, if the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a *RST immediately before the :FETCh? or if a measurement parameter was changed without an :INITiate.

OBWidth Suffix
Range: 1-2, Default = 1

:FETCh:PEAK?

Title: Fetch Peak

Description: Returns a pair (amplitude, frequency in Hz) of the peak amplitude in the current sweep. The command does not wait for the sweep to complete. If the trace data is invalid then both numbers in the pair will be NAN and error code -230 will be indicated.

6-13 :FORMat Subsystem

The Format Subsystem specifies programming data format.

:FORMat[:TRACe][:DATA] <ASCii|INTeger|REAL>,[<numeric_value>]
:FORMat[:TRACe][:DATA]?

Title: Trace Data Format

Description: This command specifies the format in which data is returned in TRAC:DATA queries. The optional numeric parameter is needed for REAL format only. It defines the length of the floating point number in bits. Valid values are 32 and 64. If the optional numeric parameter is omitted, the default length of REAL data is set to 64 bits. ASCii format returns the data in comma-separated ASCII format. The units are the current measurement units. INTeger,32 values are signed 32-bit integers in little-endian byte order. This format returns the data in 4-byte blocks. The values are scaled by 1000, so if the current measurement units are dBm the integer values would be mdBm. For example, if the measured result was -12.345 dBm, that value would be sent as -12345. REAL,32 values are 32-bit floating point numbers conforming to the IEEE 754 standard in little-endian byte order. This format returns the data in 4-byte binary format. The units are the current measurement units. REAL,64 values are 64-bit floating point numbers conforming to the IEEE 754 standard in little-endian byte order. This format returns the data in 8-byte binary format. The units are the current measurement units.

Parameter(s): <ASCii | INTeger | REAL>,[<numeric_value>]

Query Return: ASC | INT | REAL

Default Value: ASCii

6-14 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate:CONTinuous <0 | 1 | ON | OFF>
:INITiate:CONTinuous?

Title: Sweep Type

Description: Specifies whether the sweep/measurement is triggered continuously. If the value is set to ON or 1, another sweep/measurement is triggered as soon as the current one completes. If continuous is set to OFF or 0, the instrument remains initiated until the current sweep/measurement completes, then enters the 'idle' state and waits for the :INITiate[:IMMediate] command or for :INITiate:CONTinuous ON. If :INITiate:CONTinuous is changed to ON before the current sweep/measurement completes, a new sweep/measurement will be continuously triggered as soon as the current sweep/measurement completes. If :INITiate[:IMMediate] is received before the current sweep/measurement completes, it will be ignored. Clients must either wait for the current sweep/measurement to complete before triggering a 'single sweep', or :ABORt the sweep/measurement after setting :INITiate:CONTinuous to OFF (which will cause the instrument to immediately enter the idle state where it can accept new triggers). The default value is ON. That is, sending :INIT:CONT is equivalent to sending :INIT:CONT ON. The query version of the command returns a 1 if the instrument is continuously sweeping/measuring and returns a 0 if the instrument is in single sweep/measurement mode.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: ON

:INITiate[:IMMediate]

Title: Initiate Single Sweep

Description: Initiates a sweep/measurement. If :INITiate:CONTinuous is set to ON, or if :INITiate:CONTinuous is set to OFF but the current sweep has not completed yet, this command is ignored. Use this command in combination with :STATus:OPERation? or *OPC? to synchronize the capture of one complete set of data. When this command is sent, the "sweep complete" bit of :STATus:OPERation? is set to 0, indicating that the measurement has not completed. The data collection is then triggered. The controlling program can poll :STATus:OPERation? to determine the status. When the "sweep complete" bit is set to 1, data is ready to be retrieved. This command is also overlapped, so alternatively, *OPC? can be used to wait for completion of the measurement without polling. When this command is received, the pending operation bit is set. The pending operation will finish once the sweep/measurement is done. Clients can use *OPC? to 'block' until the sweep/measurement is completed.

:INITiate[:IMMediate]:ALL

Title: Initiate Average Count Sweep

Description: Initiates sweep untill all active traces reach its average count

:INITiate:SPA:SELFtest?

Title: Self Test

Description: Perform a self-test and return the results. The response is formatted as a JSON (http://json.org/) array of name,value pair result objects. Some result objects also include a 'status' property that will be either 'pass' or 'fail' based on whether the criteria for that test was met. For tests of voltages, the test passes if the measured voltage is within 10% of the expected voltage.

6-15 :INPut Subsystem

:INPut:OPOWer:RELay[:STATe] <CLOSed|OPEN>
:INPut:OPOWer:RELay[:STATe]?

Title: Set Relay State

Description: Query the state of the overpower relay, or close it. During an overpower condition, the relay will open automatically to prevent damage to RF circuitry, and the device dependent error bit in the ESR will be set to indicate that an overpower condition occurred. Additionally the instrument will automatically try to close the relay every hour after it detects that the relay is opened To recover, remove the offending input source and then issue this command with a parameter of CLOSed to close the relay or wait for an hour from the time when the relay was opened for the instrument to close the relay automatically. Note that while this command returns the relay state as "CLOSed|OPEN", this command only accepts "CLOSed as a parameter" (that is, the relay cannot be manually opened, only closed). Recovering from an overpower condition requires user interaction, either manually or via an automated program that can send this SCPI command to the instrument or the instrument can itself try closing the relay every hour after it detects an open state. Additionally, if the relay is CLOSed without removing the source of the overpower, it will immediately revert to OPEN.

Parameter(s): <CLOSed|OPEN>

Query Return: CLOS|OPEN

Default Value: CLOSed

6-16 :INSTrument Subsystem

One instrument may contain many logical instruments (“modes”). This subsystem controls the selection of the current instrument mode.

:INSTrument:ACTive:STATe <0 | 1 | ON | OFF>
:INSTrument:ACTive:STATe?

Title: RemoteSpectrumAnalyzerInUse

Description: Set state of this setting indicates that rsm is used by someone. Unset state indicates it is not used by anyone

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:INSTrument:REMote:STATe <0 | 1 | ON | OFF>,<string>
:INSTrument:REMote:STATe?

Title: RemoteSpectrumAnalyzerId

Description: This command can be used to indicate the device being used by someone. The set command takes two parameters: - a boolean to indicate whether the device is being used - a string to indicate the identification of someone currently using the device. When a value of 1 is passed into the boolean parameter (indicating the device being used), the identification string parameter must be non-empty; otherwise, a scpi error will be generated. When no longer being used, these settings should be cleared with a boolean parameter of zero. The string parameter does not matter because it will automatically be set to the empty string. The query command returns the current values of the boolean and the string settings. The remote identification string setting is empty only if it has never been set or has been cleared via this command. Both settings will be reset after a reboot.

Parameter(s): <0 | 1 | ON | OFF>,<string>

6-17 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. The MEASure Subsystem commands correct any Parameters that are invalid given the new measurement state such that a valid measurement can take place. Other settings may be changed; see the documentation of `CONFigure` for each measurement. The MEASure commands then initiate the measurement. The result is returned as the measurement completes.

To make a measurement with settings other than the "default" measurement settings applied by `CONFigure`, do the following:

- Send the appropriate `CONFigure` command to set the desired measurement.
- Modify the settings as required.
- Send the appropriate `READ` command to measure and return the result.

To get the current measurement data, use the appropriate `FETCh` command.

:MEASure:ACPower?

Title: Measure Adjacent Channel Power Ratio

Description: Sets the active measurement to adjacent channel power ratio, sets the default measurement parameters, triggers a new measurement and returns the main channel power, lower adjacent, upper adjacent, lower alternate and upper alternate channel power results. It is a combination of the commands :CONFigure:ACPower; :READ:ACPower? For a description of the default adjacent channel power ratio measurement parameters see :CONFigure:ACPower. To make an adjacent channel power ratio measurement with settings other than the default values send: :CONFigure:ACPower Commands to set desired settings :READ:ACPower? Data is returned as 9 comma-separated values: main channel power, absolute lower adjacent channel power, absolute upper adjacent channel power, absolute lower alternate channel power, absolute upper alternate channel power, relative lower adjacent channel power, relative upper adjacent channel power, relative lower alternate channel power, relative upper alternate channel power.

:MEASure:CHPower?

Title: Measure Channel Power And Density

Description: Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns the channel power and channel power density results. It is a combination of the commands :CONFigure:CHPower; :READ:CHPower? For a description of the default channel power measurement parameters see :CONFigure:CHPower. To make a channel power measurement with settings other than the default values send: :CONFigure:CHPower Commands to set desired settings :READ:CHPower? Data is returned as 2 comma-separated values: channel power, channel power density.

:MEASure:CHPower:CHPower?

Title: Measure Channel Power

Description: Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns channel power as the result.To measure both channel power and channel power density use MEASure:CHPower? It is a combination of the commands :CONFigure:CHPower; :READ:CHPower? For a description of the default channel power measurement parameters see :CONFigure:CHPower. To make a channel power measurement with settings other than the default values send: :CONFigure:CHPower Commands to set desired settings :READ:CHPower?

:MEASure:CHPower:DENSity?

Title: Measure Channel Power Density

Description: Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns channel power density as the result. To measure both channel power and channel power density use MEASure:CHPower? It is a combination of the commands :CONFigure:CHPower; :READ:CHPower? For a description of the default channel power measurement parameters see :CONFigure:CHPower. To make a channel power measurement with settings other than the default values send: :CONFigure:CHPower Commands to set desired settings :READ:CHPower?

:MEASure:IQ:CAPTure

Title: StartIQCapature

Description: This set command is used to start the IQ capture measurement. If IQ:MODE is SINGle, this command will trigger a single I/Q block capture. While the capture is in progress the I/Q Capture bit of STATus:OPERation? will be set to 1. Clients can read the captured data with the TRAC:IQ:DATA? query. If IQ:MODE is STREAM, this command will start streaming capture of I/Q data. The most recently captured block of I/Q data can be read with the TRAC:IQ:DATA? query. In STREAM capture mode, the capture will not complete until aborted. While streaming is going, clients will need to continuously read captured blocks with TRAC:IQ:DATA?. Regardless of the capture mode, the capture can be aborted. The capture can be aborted with the ABORt command preferably, though most commands which change hardware settings will also abort the capture (clients should assume that any non-query command sent while a capture is in progress will abort the capture). To determine if the capture was aborted, check the output of STATus:OPERation?. The capture will also be 'paused' if the instrument detects an overpower or overheat condition: in this situation, any pending TRAC:IQ:DATA? query will immediately return #0 and a device-specific error will be added to the SCPI error queue. When the condition is rectified (either by removing the source of the overpower and closing the overpower relay, or waiting for the instrument to cool down), the capture

will automatically restart. Additionally if the instrument detects a change in reference source (either due to a loss/acquisition of GPS or a connection/disconnection of external reference) a device-specific error will be added to the SCPI error queue. In either capture mode, this command will do nothing if a capture is already in progress. The device-specific errors this command adds to the SCPI error queue include a description that looks like the following: Device-specific error; Reference source changed during capture @ Thu Jun 18 17:02:03 2015 Device-specific error; Capture paused due to overheating @ Thu Jun 18 17:02:03 2015 Device-specific error; Capture paused due to RF overpower @ Thu Jun 18 17:02:03 2015 Each description contains the reason for the error and a timestamp when the error occurred. If the sweep mode (see SENSe:SWEep:MODe) is not currently FFT, this command will set it to FFT prior to starting the capture.

6-18 :OUTPut Subsystem (for MS27100A models only)

:OUTPut:IF:STATe <0 | 1 | ON | OFF>
:OUTPut:IF:STATe?

Title: IF Output State

Description: Toggles the analog IF output on/off.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

6-19 :READ Subsystem

This set of commands combines the ABORt, INITiate and FETCh commands. It aborts any current triggering sequence and sets the trigger state to idle. It then initiates a new active measurement (i.e. begins the collection of new data). When the measurement is complete, it returns the result. These commands will not switch to another measurement. To get the current measurement data, use the FETCh command.

:READ:ACPower?

Title: Read Adjacent Channel Power Ratio

Description: Triggers a new adjacent channel power ratio measurement and returns the results: main channel power, lower adjacent and upper adjacent channel power. It is a combination of the commands :ABORT; :INITiate; :FETCh:ACPower? The channel power measurement must be the active measurement (specified by the command :CONFigure:ACPower). The current measurement can be queried using the command :CONFigure? Data is returned as 9 comma-separated values: main channel power, absolute lower adjacent channel power, absolute upper adjacent channel power, absolute lower alternate channel power,absolute upper alternate channel power, relative lower adjacent channel power, relative upper adjacent channel power, relative lower alternate channel power,relative upper alternate channel power. If the measurement is not active, the instrument will indicate error -400 and return the string "nan,nan,nan,nan,nan". If :INITiate command fails it returns a string "nan,nan,nan,nan,nan,nan,nan,nan,nan"

:READ:CHPower?

Title: Read Channel Power And Density

Description: Triggers a new channel power measurement and returns the results: channel power and channel power density. It is a combination of the commands :ABORT; :INITiate; :FETCh:CHPower? The channel power measurement must be the active measurement (specified by the command :CONFigure:CHPower).Data is returned as 2 comma-separated values: channel power, channel power density.If the measurement is not active, the instrument will indicate error -400 and return the string "nan,nan". If :INITiate command fails it returns a string "nan,nan"

:READ:CHPower:CHPower?

Title: Read Channel Power And Density

Description: Triggers a new channel power measurement and returns the channel power result: channel power and channel power density. It is a combination of the commands :ABORT; :INITiate; :FETCh:CHPower? The channel power measurement must be the active measurement (specified by the command :CONFigure:CHPower).Data returned is : channel power. If the measurement is not active, the instrument will indicate error -400 and return the string "nan" If :INITiate command fails it returns a string "nan"

:READ:CHPower:DENSity?

Title: Read Channel Power And Density

Description: Triggers a new channel power measurement and returns the results: channel power and channel power density. It is a combination of the commands :ABORT; :INITiate; :FETCh:CHPower? The channel power measurement must be the active measurement (specified by the command :CONFigure:CHPower).Data returned is : channel power density.If the measurement is not active, the instrument will indicate error -400 and return the string "nan". If :INITiate command fails it returns a string "nan"

6-20 :ROUTe Subsystem

:ROUTe:CPRI:CLOSe <numeric_value> | DEFault | MINimum | MAXimum
:ROUTe:CPRI:CLOSe? [DEFault | MINimum | MAXimum]

Title: CPRI Antenna Container

Description: Close the specified SFP channel, setting which SFP input to route from. Two SFPs are available but only one can be used at a time.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 1

Range: 1 to 2

:ROUTe:INPut:CLOSe <numeric_value>
:ROUTe:INPut:CLOSe? <numeric_value>

Title: Switch RF Input

Description: Set the port number of an Antenna Multiplexer Device. Both the set and query command take a parameter specifying a port number. The query version returns 1 if the specified port is currently set, otherwise it returns 0. Available number of ports on the antenna multiplexer device is determined by model number and option number of the system

Parameter(s): <numeric_value>

Query Return: Numeric

Default Value: 1

Range: 1 to 24

:ROUTe:INPut:CLOSe:MODE <RECall|STATic>
:ROUTe:INPut:CLOSe:MODE?

Title: Switch RF Input Recall Setup Mode

Description: Sets whether the port specific setup will be recalled when switching the port number of the Antenna Multiplexer Device. Note that this setting is not persistent through a power cycle, but keeps the value through recalling user setup files or user measurement files. When recalling a user setup in the STATic mode, the setup of the Antenna Mux value in the setup file will be used as the static port setup when toggling Antenna Mux ports. The query returns either REC or STAT. If the setting is set to REC, the instrument will recall the port specific setup during every port change of the Antenna Multiplexer Device. A STAT setting value means that the port setup will not change when changing the port of the Antenna Multiplexer Device.

Parameter(s): <RECall|STATic>

Query Return: REC|STAT

Default Value: RECall

:ROUTe:INPut:CLOSe:STATe?

Title: Query RF Input Switch

Description: Query the instrument for the state of the an Antenna Multiplexer Device. The response is in the form of a SCPI channel list (i.e. IEEE definite length arbitrary block response '#AX<block>', where A is the number of digits in X, X is the number of bytes in <block>, and <block> is the ASCII representation of the currently closed port).Avaliable number of ports on the antenna multiplexer device is determined by model number and option number of the system.

6-21 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent? [DEFault | MINimum | MAXimum]

Title: Adjacent Chpwr Adjacent Integration Bandwidth

Description: Sets the adjacent channel bandwidth for adjacent channel power measurement. Integration bandwidth must be less than or equal to span

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10350000 Hz

Default Unit: Hz

Range: 10 Hz to 400000000000 Hz

[:SENSe]:ACPower:BANDwidth|BWIDth:ALTernate <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:ACPower:BANDwidth|BWIDth:ALTernate? [DEFault | MINimum | MAXimum]

Title: Adjacent Chpwr Alternate Integration Bandwidth

Description: Sets the alternate channel bandwidth for adjacent channel power measurement. Integration bandwidth must be less than or equal to span

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10350000 Hz

Default Unit: Hz

Range: 10 Hz to 400000000000 Hz

[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN? [DEFault | MINimum | MAXimum]

Title: Adjacent Chpwr Main Integration Bandwidth

Description: Sets the main channel bandwidth for adjacent channel power measurement. Integration bandwidth must be less than or equal to span

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10350000 Hz

Default Unit: Hz

Range: 10 Hz to 400000000000 Hz

[:SENSe]:ACPower:BANDwidth|BWIDth:SPACing <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:ACPower:BANDwidth|BWIDth:SPACing? [DEFault | MINimum | MAXimum]

Title: Adjacent Channel Power Spacing

Description: Controls the channel spacing which is the distance from the modulated carrier signal to the upper or lower Adjacent Channel.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10350000 Hz

Default Unit: Hz

Range: 10 Hz to 400000000000 Hz

[:SENSe]:ACPower:STATe <0 | 1 | ON | OFF>
[:SENSe]:ACPower:STATe?

Title: Adjacent Channel Power State

Description: Sets the state of the adjacent channel power ratio measurement, ON or OFF. When using :CONFigure:ACPower, the state is automatically set to ON

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

[:SENSe]:AVERage:COUNt <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:AVERage:COUNt? [DEFault | MINimum | MAXimum]

Title: Sense Average Count

Description: Sets the effective number of averages and the length of the rolling min and max hold. Due to memory limitations the actual length of buffers for rolling min and max hold are limited to 2,000,000 / number of trace points.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10

Range: 2 to 1000

[:SENSe]:AVERage:TYPE
<NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage>
[:SENSe]:AVERage:TYPE?

Title: Sense Average Type

Description: Specifies how successive traces are combined to produce the resulting display value. Only applies to trace 1. Setting the TYPE to NORMal will cause the displayed value for a point to be the current measured value for that point. Setting the TYPE to AVERage will cause the displayed value for a point to be the average of the last <integer> measured values where <integer> is set by [:SENSe]:AVERage:COUNt. Setting the TYPE to MAXimum will cause the displayed value for a point is the maximum measured value for that point over sweeps. Setting the TYPE to MINimum will cause the displayed value for a point is the minimum measured value for that point over sweeps.Setting the TYPE to RMAXimum will cause the displayed value for a point to be the maximum of the last <integer> measured values where <integer> is set by [:SENSe]:AVERage:COUNt.Setting the TYPE to RMINimum will cause the displayed value for a point to be the minimum of the last <integer> measured values where <integer> is set by [:SENSe]:AVERage:COUNt.

Parameter(s): <NORMal | MINimum | MAXimum | AVERage | RMAXimum | RMINimum | RAVerage>

Query Return: NORM | MIN | MAX | AVER | RMAX | RMIN | RAV

Default Value: NORMal

[:SENSe]:BANDwidth|BWIDth[:RESolution] <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:BANDwidth|BWIDth[:RESolution]? [DEFault | MINimum | MAXimum]

Title: RBW

Description: Sets the resolution bandwidth. Note that using this command turns the automatic resolution bandwidth setting OFF.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 3000000 Hz

Default Unit: Hz

Range: 10 Hz to 3000000 Hz

[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio? [DEFault | MINimum | MAXimum]

Title: RBW Span Ratio

Description: Sets the ratio of the resolution bandwidth to the span for use when the resolution bandwidth to span coupling is enabled. Note that the front panel interface sets the inverse ratio: the span to the resolution bandwidth.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0.01

Range: 1e-05 to 1

[:SENSe]:BANDwidth|BWIDth:SHAPe <FLATtop|NUTall>
[:SENSe]:BANDwidth|BWIDth:SHAPe?

Title: Rbw Filter Type

Description: This command sets the rbw filter type, Flat Top window or Nutall.

Parameter(s): <FLATtop|NUTall>

Query Return: FLAT|NUT

Default Value: FLATtop

[:SENSe]:BANDwidth|BWIDth:VIDeo <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:BANDwidth|BWIDth:VIDeo? [DEFault | MINimum | MAXimum]

Title: VBW

Description: Sets the video bandwidth. Note that using this command turns the automatic video bandwidth setting OFF.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 1000000 Hz

Default Unit: Hz

Range: 1 Hz to 3000000 Hz

[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio? [DEFault | MINimum | MAXimum]

Title: VBW RBW Ratio

Description: Sets the ratio of the video bandwidth to the resolution bandwidth for use when the video to resolution bandwidth coupling is enabled. Note that the front panel interface sets the inverse ratio: the resolution bandwidth to the video bandwidth which is an integer, in other words, if you send 0.35, the display will show 2 not 2.857

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0.33

Range: 1e-05 to 1

[:SENSe]:BANDwidth|BWIDth:VIDeo:TYPE <LINear|LOGarithmic>
[:SENSe]:BANDwidth|BWIDth:VIDeo:TYPE?

Title: VBW Averaging

Description: Changes the VBW/Average type.

Parameter(s): <LINear|LOGarithmic>

Query Return: LIN|LOG

Default Value: LINear

[:SENSe]:BANDwidth[:RESolution]:AUTO <0 | 1 | ON | OFF>
[:SENSe]:BANDwidth[:RESolution]:AUTO?

Title: RBW Auto

Description: Sets the state of the coupling of the resolution bandwidth to the frequency span. Setting the value to ON or 1 will result in the resolution bandwidth being coupled to the span. That is, when the span changes, the resolution bandwidth changes. Setting the value to OFF or 0 will result in the resolution bandwidth being uncoupled from the span. That is, changing the span will not change the resolution bandwidth. When this command is issued, the resolution bandwidth setting itself will not change

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: ON

[:SENSe]:BANDwidth:VIDeo:AUTO <0 | 1 | ON | OFF>
[:SENSe]:BANDwidth:VIDeo:AUTO?

Title: VBW Auto

Description: Sets the state of the coupling of the video bandwidth to the resolution bandwidth. Setting the value to ON or 1 will result in the video bandwidth being coupled to the resolution bandwidth. That is, when the resolution bandwidth changes, the video bandwidth changes. Setting the value to OFF or 0 will result in the video bandwidth being uncoupled from the resolution bandwidth. That is, changing the resolution bandwidth will not change the video bandwidth

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: ON

[:SENSe]:CAPTure:TIMe <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum
[:SENSe]:CAPTure:TIMe? [DEFault | MINimum | MAXimum]

Title: Capture Time

Description: Determines how much time to spend taking samples for each portion of the spectrum. Increasing the capture time is useful for detecting modulated signals (frequency or amplitude modulation). The query version of this command reports the setting value in milliseconds.

Query Return: Numeric (ms)

Set Command Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 ms

Default Unit: ms

Range: 0 ms to 10000 ms

[:SENSe]:CAPTure:TIMe:ACTUal? [DEFault | MINimum | MAXimum]

Title: Actual Capture Time

Description: Returns actual time spent taking samples for each portion of the spectrum. The query version of this command reports the setting value in milliseconds.

Query Return: Numeric (ms)

Default Value: 0 ms

Default Unit: ms

Range: 0 ms to 11000 ms

[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration? [DEFault | MINimum | MAXimum]

Title: Chpwr Integration Bandwidth

Description: Sets the integration bandwidth for channel power measurement. Integration bandwidth must be less than or equal to span

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10350000 Hz

Default Unit: Hz

Range: 10 Hz to 400000000000 Hz

[:SENSe]:CHPower:STATe <0 | 1 | ON | OFF>
[:SENSe]:CHPower:STATe?

Title: Channel Power State

Description: Sets the state of the channel power measurement, ON or OFF. When using :CONFigure:CHPower,the state is automatically set to ON

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

[:SENSe]:CPRI:AGGRegation <0 | 1 | ON | OFF>
[:SENSe]:CPRI:AGGRegation?

Title: CPRI Carrier Aggregation

Description: Enable or disable carrier aggregation on the CPRI link.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

[:SENSe]:CPRI:AXC <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:CPRI:AXC? [DEFault | MINimum | MAXimum]

Title: CPRI Antenna Container

Description: Set the AxC (antenna container) number of the CPRI link.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0

Range: 0 to 10

[:SENSe]:CPRI:BANDwidth <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:CPRI:BANDwidth? [DEFault | MINimum | MAXimum]

Title: CPRI Bandwidth

Description: Sets the CPRI bandwidth. This value must match the configuration of the connected RRH (remote radio head) in order to make a valid measurement. Only the following bandwidths are available: 5 MHz, 10 MHz, 15 MHz, 20 MHz

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10000000 Hz

Default Unit: Hz

Range: 5000000 Hz to 20000000 Hz

[:SENSe]:CPRI:IQ:BITS <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:CPRI:IQ:BITS? [DEFault | MINimum | MAXimum]

Title: CPRI I/Q Bit Width

Description: Set the I/Q bit width used in the CPRI link. This value must match the configuration of the connected RRH (remote radio head) in order to make a valid measurement. Only the following bit widths are available: 10, 12, 15, 16

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 15

Range: 10 to 16

[:SENSe]:CPRI:IQ:BITS:REServe <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:CPRI:IQ:BITS:REServe? [DEFault | MINimum | MAXimum]

Title: CPRI Reserve Bits

Description: Set the number of reserve bits used in the CPRI link. This value must match the configuration of the connected RRH (remote radio head) in order to make a valid measurement.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0

Range: 0 to 10

[:SENSe]:CPRI:LRATe <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:CPRI:LRATe? [DEFault | MINimum | MAXimum]

Title: CPRI Line Rate

Description: Set the line rate of the CPRI link, in MBPS (million bits per second). This value must match the configuration of the connected RRH (remote radio head) in order to make a valid measurement. Only the following rates are available (in MBPS): 614.4 1228.8 2457.6 3072 4915.2 6144 9830.4 10137.6

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 2457.6

Range: 614.4 to 10137.6

[:SENSe]:DETector[:FUNCtion] <POS|RMS|NEG|SAMP>
[:SENSe]:DETector[:FUNCtion]?

Title: Detection Mode

Description: Sets the detection method for calculating each display point. Each display point represents several measurements. The detection type determines how the display point is derived from its associated measurements. POSitive Peak detection displays the maximum value of the associated measurements. RMS detection displays the average power of the associated measurements. NEGative Peak detection displays the minimum value of the associated measurements.

Parameter(s): <POS|RMS|NEG|SAMP>

[:SENSe]:FREQuency:BAND:MODE <THRU|BPF1|BPF2|BPF3>
[:SENSe]:FREQuency:BAND:MODE?

Title: Pre-Selector

Description: Sets the pre-selector to pass input through or to filter input in a specific frequency band. Setting the pre-selector to THRU passes the input without any filtering. Setting the pre-selector to BPF1 will filter out all input signals outside of the 88 MHz - 108 MHz band. Setting the pre-selector to BPF2 will filter out all input signals outside of the 600 MHz - 1200 MHz band. Setting the pre-selector to BPF3 will filer out all input signals outside of the 1600 MHz - 2800 MHz band. The query command will return the current pre-selector setting value as a short form enumerable value (THRU, BPF1, BPF2, or BPF3)

Parameter(s): <THRU | BPF1 | BPF2 | BPF3>

Query Return: THRU | BPF1 | BPF2 | BPF3

Default Value: THRU

[:SENSe]:FREQuency:CENTer <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:FREQuency:CENTer? [DEFault | MINimum | MAXimum]

Title: Center Frequency

Description: Sets the center frequency. Note that changing the value of the center frequency will change the value of the coupled parameters Start Frequency and Stop Frequency. It may also change the value of the span.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 3000000000 Hz

Default Unit: Hz

Range: -99999999995 Hz to 299999999995 Hz

[:SENSe]:FREQuency:OFFSet <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:FREQuency:OFFSet? [DEFault | MINimum | MAXimum]

Title: Frequency Offset

Description: Set a frequency offset, which will be added to the start, stop, and center frequencies. This offset is for display purposes only and does not affect the frequency range being measured. This command is only applicable when making CPRI measurements.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 Hz

Default Unit: Hz

Range: -10000000000 Hz to 10000000000 Hz

[:SENSe]:FREQuency:REFerence:SOURce?

Title: Frequency Reference Source

Description: Returns the current frequency reference source used by the instrument, as specified in the following table: Return value Description GPS GPS High Accuracy ACQ Acquiring GPS Reference INV Invalid (error locking to external reference) INT Internal Standard Accuracy EXT External (10 MHz) Reference

Query Return: GPS | INV | INT | EXT | ACQ | UNK

Default Value: INT

[:SENSe]:FREQuency:SPAN <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:FREQuency:SPAN? [DEFault | MINimum | MAXimum]

Title: Span

Description: Sets the frequency span. Setting the value of <freq> to 0 Hz is the equivalent of setting the span mode to zero span. Note that changing the value of the frequency span will change the value of the coupled parameters Start Frequency and Stop Frequency and may change the Center Frequency.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 400000000000 Hz

Default Unit: Hz

Range: 10 Hz to 400000000000 Hz

[:SENSe]:FREQuency:SPAN:FULL

Title: Set to Full Span

Description: Sets the frequency span to full span. Note that changing the value of the frequency span will change the value of the coupled parameters, Start Frequency and Stop Frequency and may change the Center Frequency.

[:SENSe]:FREQuency:SPAN:LAST

Title: Set to Last Span

Description: Sets the frequency span to the previous span value. Note that changing the value of the frequency span will change the value of the coupled parameters, Start Frequency and Stop Frequency and may change the Center Frequency.

[:SENSe]:FREQuency:STARt <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:FREQuency:STARt? [DEFault | MINimum | MAXimum]

Title: Start Frequency

Description: Sets the start frequency. Note that in the spectrum analyzer, changing the value of the start frequency will change the value of the coupled parameters, Center Frequency and Span.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 Hz

Default Unit: Hz

Range: -100000000000 Hz to 299999999990 Hz

[:SENSe]:FREQuency:STEP[:INCRement] <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:FREQuency:STEP[:INCRement]? [DEFault | MINimum | MAXimum]

Title: Frequency Step

Description: Set or query the step size to gradually increase or decrease frequency value. This command doesn't change any behavior in the backend but will be included in save/recall operations.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 100000 Hz

Default Unit: Hz

Range: 1000 Hz to 1000000000 Hz

[:SENSe]:FREQuency:STOP <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum
[:SENSe]:FREQuency:STOP? [DEFault | MINimum | MAXimum]

Title: Stop Frequency

Description: Sets the stop frequency. Note that in the spectrum analyzer, changing the value of the stop frequency will change the value of the coupled parameters, Center Frequency and Span.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 6000000000 Hz

Default Unit: Hz

Range: -99999999990 Hz to 300000000000 Hz

[:SENSe]:IMAGe[:REJection] <NLOW|NHIGh|NORMal>
[:SENSe]:IMAGe[:REJection]?

Title: Image Rejection

Description: This command sets/queries image rejection mode. NLOW sets local oscillator (LO) to lowside only. NHIGh sets LO to highside only. Default is NORMal which engages both high and low and applies the image rejection algorithm.

Parameter(s): <NLOW | NHIGh | NORMal>

Query Return: NLOW | NHIG | NORM

Default Value: NORMal

[:SENSe]:IQ:BANDwidth <numeric_value> {HZ | KHZ | MHZ | GHZ} |DEFault | MINimum | MAXimum
[:SENSe]:IQ:BANDwidth? [DEFault | MINimum | MAXimum]

Title: Capture Bandwidth

Description: Sets or queries the capture bandwidth of I/Q data captured by MEASURE:IQ:CAPTURE. Only these values are valid: 20000000 13300000 6670000 2670000 1330000 667000 267000 133000 66700 26700 13300 6670 2670 1330 667 267 133 67 This setting configures data decimation factors in the I/Q capture engine to provide an effective capture bandwidth of at least the amount specified.

Query Return: Numeric (Hz)

Set Command Parameter(s): <numeric_value> {HZ | KHZ | MHZ | GHZ} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 2670000 Hz

Default Unit: Hz

Range: 0 Hz to 100000000 Hz

[:SENSe]:IQ:BITS <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:IQ:BITS? [DEFault | MINimum | MAXimum]

Title: IQ Bits per Sample

Description: The number of IQ bits per sample. Lower values enable higher throughput (continuous IQ capture) or longer maximum capture length (block IQ capture). The number of samples per frame increases as the bits per sample decreases: Bits per sample Samples per frame 24 1 16 2 10 3 8 4

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 24

Range: 8 to 24

[:SENSe]:IQ:LENGth <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum
[:SENSe]:IQ:LENGth? [DEFault | MINimum | MAXimum]

Title: Capture Length

Description: The set form of this command sets the iq length in milliseconds and query form returns the iq length in milliseconds

Query Return: Numeric (ms)

Set Command Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 10000 ms

Default Unit: ms

Range: 0.001 ms to 100000000 ms

[:SENSe]:IQ:MODE <SINGle|STREam>
[:SENSe]:IQ:MODE?

Title: Capture Mode

Description: Specifies the type of capture mode 1.Single mode does a single block capture 2.Streaming mode does real time streaming capture

Parameter(s): <SINGle|STREam>

Query Return: SING|STRE

Default Value: SINGle

[:SENSe]:IQ:SAMPle:CALibration:CONFiguration?

Title: IQ Sample Calibration Configuration

Description: In order to get the valid IQ correction factor, user should issue MEAS:IQ:CAPT command first. Returns a comma delimited list of I/Q measurement configuration and calibration coefficients information with 7 fields: Center frequency, Preamp state, Input attenuation, IQ base sample rate, Decimation factor, IQ capture bandwidth, IQ correction factor in dB, An invalid value of -20000 is returned if any of Center frequency, Preamp state, Input attenuation, IQ capture bandwidth settings is modified after issuing MEAS:IQ:CAPT command To apply the IQ correction factor, please refer to the Remote Spectrum Monitoring System Help Introduction. Information is available in I/Q Capture Block Mode section of the manual (full path: Remote Spectrum Monitor/Programming with SCPI/I/Q Capture Block Mode)

[:SENSe]:IQ:SAMPle:CONFiguration?

Title: IQ Configuration

Description: Returns a comma delimited list of I/Q measurement configuration information with 5 fields: Base sample rate, Number of bytes per frame, Effective bits per sample (see SENSE:IQ:BITS), Decimation factor, Timestamp (see SENSE:IQ:TIMESTAMP), The base sample rate is generally fixed in a specific hardware revision; its value is provided here to enable calculation of the data rate, or time between samples, which is equal to the base sample rate divided by the decimation factor. The data rate is used when extrapolating embedded timestamps to other samples. For example, assuming a data rate of 1 MHz, if the nth sample contains an embedded timestamp of 1444753342s + 37531655ns, the n+1th sample would have an effective timestamp of 1444753342s + 37531655ns + (1/1MHz) = 1444753342s + 37531655ns + 1ms = 1444753342s + 37532655ns. The number of samples per frame is calculated by: floor(bitsPerFrame / bitsPerSample), where bitsPerFrame = 8 * bytesPerFrame Decimation factor is read only, and its value is derived from the current capture bandwith setting. There is a 1-to-1 correspondence between an IQ:BAND value and a decimation factor. Number of bytes per sample is 8 for I/Q and 2 for raw ADC capture. The raw ADC capture must be parsed differently. See TRAC:IQ:DATA? for the data format. This command provides the information necessary for clients to reconstruct I/Q data samples and timestamps from the raw data returned by TRAC:IQ:DATA?.

[:SENSe]:IQ:TIMEstamps <0 | 1 | ON | OFF>
[:SENSe]:IQ:TIMEstamps?

Title: IQ Timestamps

Description: Enables or disables IQ timestamps. When I/Q timestamps are enabled, timestamps will be embedded in the binary response data returned by TRACe:IQ:DATA?. The first 256 frames of each 1024 frame chunk use the least-significant bit of each I and Q sample in each frame for timestamping. If SENS:IQ:BITS is 24 or 10, the timestamp does not reduce resolution. If SENS:IQ:BITS is 16 or 8, the timestamp reduces the resolution by one bit for 256/1024 frames. In the 16 bit case, 256/2048 samples are 15 bits. In the 8 bit case, 256/4096 samples are 7 bits. If SENS:IQ:TIMESTAMPS is OFF, then the IQ data cannot be absolutely positioned in time, but all samples have full resolution. This setting is ignored if SENSE:IQ:BITS is 24 or 10 bits because there are extra, otherwise unused bits. The timestamps are shift-encoded in groups of 64 in bit 0, and there is a shift-encoded mark in bit 32.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: ON

[:SENSe]:MODe <SPECtrum|NRADio>
[:SENSe]:MODe?

Title: Spa mode

Description: Set the operational mode of the Spa app. SPECtrum for the default spectrum mode. NRADio for 5G demodulation measurements

Parameter(s): <SPECtrum|NRADio>

Query Return: SPEC|NRAD

Default Value: SPECtrum

[:SENSe]:OBWidth:METHod <XDB|PERCent>
[:SENSe]:OBWidth:METHod?

Title: Occupied Bandwidth Method

Description: Sets the method for calculating occupied bandwidth. XDB calculates the occupied bandwidth based on points a specified number of dB below the carrier. Issue command [:SENSe]:OBWidth:XDB to set the number of dB to be used. PERCent calculates the occupied bandwidth based on points a specified percentage of the carrier power below the carrier. Issue command [:SENSe]:OBWidth:PERCent to set the percentage to be used. The measurement always gives a result, even if there is no signal. For example, the 100 dBc Occupied Bandwidth is the current full span.

Parameter(s): <XDB|PERCent>

Query Return: XDB|PERC

Default Value: PERCent

[:SENSe]:OBWidth:PERCent <numeric_value> | DEFault | MINimum | MAXimum
[:SENSe]:OBWidth:PERCent? [DEFault | MINimum | MAXimum]

Title: Occupied Bandwidth Percent

Description: This command sets the percentage of carrier power used to measure the occupied bandwidth. This value is used in the measurement if :SENSe:OBWidth:METHod is set to PERCent.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 99

Range: 1e-06 to 99.999999

[:SENSe]:OBWidth:STATe <0 | 1 | ON | OFF>
[:SENSe]:OBWidth:STATe?

Title: Occupied Bandwidth State

Description: Sets the state of the occupied bandwidth measurement, ON or OFF. When using :CONFigure:OBWidth, the state is automaticaly set to ON

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

[:SENSe]:OBWidth:XDB <numeric_value> {DB} | DEFault | MINimum | MAXimum
[:SENSe]:OBWidth:XDB? [DEFault | MINimum | MAXimum]

Title: Occupied Bandwidth XDB

Description: This command sets the number of dB below the carrier used to measure the occupied bandwidth. This value is used in the measurement if :SENSe:OBWidth:METHod is set to XDB.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (dB)

Set Command Parameter(s): <numeric_value> {DB} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 3 dB

Default Unit: dB

Range: 0.001 dB to 100 dB

[:SENSe]:POWer:RF:ATTenuation <numeric_value> {DB} | DEFault | MINimum | MAXimum
[:SENSe]:POWer:RF:ATTenuation? [DEFault | MINimum | MAXimum]

Title: Input Attenuation

Description: Sets the input attenuation. Note that issuing this command will set the automatic input attenuation OFF.

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (dB)

Set Command Parameter(s): <numeric_value> {DB} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 30 dB

Default Unit: dB

Range: 0 dB to 50 dB

[:SENSe]:POWer:RF:ATTenuation:AUTO <0 | 1 | ON | OFF>
[:SENSe]:POWer:RF:ATTenuation:AUTO?

Title: RF Attenuation Auto

Description: Sets the input attenuation coupling. Setting the value to ON or 1 will result in the input attenuation being coupled to the reference level. Setting the value to OFF or 0 will result in the input attenuation being uncoupled from the reference level. That is, changing the reference level will not change the input attenuation. When this command is issued, the input attenuator setting itself will not change. The default value is ON. That is, sending :SENS:POW:ATT:AUTO is equivalent to sending :SENS:POW:ATT:AUTO ON.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: ON

[:SENSe]:POWer:RF:GAIN:STATe <0 | 1 | ON | OFF>
[:SENSe]:POWer:RF:GAIN:STATe?

Title: Preamp

Description: Sets the state of the preamp. Note that this may cause a change in the reference level and/or attenuation.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

6-22 :STATus Subsystem

The commands in this subsystem relate to the current operating state of the instrument.

:STATus:OPERation[:EVENt]?

Title: Get Operation Status

Description: This command requests information about the current status of the instrument. Each bit of the return value represents some operation. Only a subset of the bits are implemented for each application. The number returned is the decimal representation of the bit-wise OR of the enabled bits: Bit Decimal Value Description 0 1 Not implemented 1 2 Not implemented 2 4 Not implemented 3 8 Not implemented 4 16 Not implemented 5 32 Not implemented 6 64 Not implemented 7 128 Not implemented 8 256 Sweep Complete This bit is set to 0 when the command :INITiate[:IMMediate] is sent to trigger a sweep. It will have a value of 1 when the sweep has completed. 9 512 I/Q Capture This bit indicates whether the instrument is currently capturing I/Q data. It is set to 1 when the MEAS:IQ:CAPT command is issued. This bit will be set to 0 when the capture is completed normally (in block mode), or is aborted, either due to the ABORt command or some other command which invalidates the capture. 10 1024 Not implemented 11 2048 Not implemented 12 4096 Not implemented 13 8192 Not implemented 14 16384 Not implemented 15 0 Will always be 0

:SWEep:MODE <FFT|NOFFt>
:SWEep:MODE?

Title: Sweep Mode

Description: Changes the current sweep mode.

Parameter(s): <FFT|NOFFt>

Query Return: FFT|NOFF

Default Value: FFT

:SYSTem:CPRI:PRESet <EULink|EDLink|ALCatel|HULink|HDLink>

Title: CPRI Radio Preset

Description: Set the instrument to a preconfigured setup for a particular radio. This command will set the CPRI Bit Width and Reserve Bits to the correct values needed to receive data from the specified radio manufacturer and band. This command takes one of the following parameters: EULink|EDLink|ALCatel|HULink|HDLink These parameters correspond to the following radio configurations: Value Meaning Bit Width Reserve Bits EULink Ericsson UL 12 6 EDLink Ericsson DL 15 0 ALCatel Alcatel UL&DL 15 0 HULink Huawei UL 12 0 HDLink Huawei DL 15 0

Parameter(s): <EULink|EDLink|ALCatel|HULink|HDLink>

6-23 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe<n>:IQ:DATA? [<numeric_value>]

Title: IQ Data

Description: This command transfers IQ data from the instrument to the controller. Data is transferred from the instrument as an IEEE definite length arbitrary block response, which has the form <header><block>. For a detailed description of the response format, see TRACe:IQ:DATA:FORMat?. If IQ:MODE? is STREAM, this command will block until the next block of streaming data is available, then return it. If IQ:MODE? is SINGle, this command will return data immediately if a capture has been already completed, or it will wait for an in-progress capture to complete before returning data, or it will return #0 if a capture has never been started. Regardless of capture mode, this command will return #0 if an error condition is encountered during an in-progress capture (see MEAS:IQ:CAPT). Clients should check the SCPI error queue with SYST:ERR:NEXT? to determine what action to take. In streaming mode there is an optional numeric parameter for the max chunks of data to return for cases where the read can't keep up.

Parameter(s): [<numeric_value>]

TRACe Suffix Range: 0, Default = 0

:TRACe:CLEar <numeric_value>

Title: Trace Clear

Description: This command clears the trace's history and current sweep data. Trace history refers to the previous trace data used to calculate trace types such as min/max hold and averaging.

Parameter(s): <numeric_value>

:TRACe:CLEar:ALL

Title: All Traces Clear

Description: This command clears the trace history and current sweep data for all traces. Trace history refers to the previous data used to calculate trace types such as min/max hold and averaging.

:TRACe[:DATA]? <numeric_value>

Title: Trace Data

Description: This command transfers trace data from the instrument to the controller. Data is transferred from the instrument as an IEEE definite length arbitrary block response, which has the form <header><block>. This command takes a single integer parameter specifying the trace number to transfer. If the parameter value is out of the range of valid trace numbers, the first trace (1) will be transferred. (Currently only one trace is supported, so this parameter has no effect.) The binary block header specifies the number of data bytes. It looks like #AX, where A is the number of digits in X and X is the number of bytes in the <block>. The first character is the literal ascii hash '#' 043. The second character (A) is a single ascii digit '1' to '9' describing the number of bytes in the length section (X). This number is called nlength. The next nlength bytes make up an ascii string of digits '1' to '9' describing the length of the <block> data. For example, if the first 6 bytes are #49999, then the nlength is 4. The 4 bytes of length are 9999. After that follows the <block>, which would be 9999 bytes in size. The format of the block data depends on the current data format setting (FORMat[:TRACe][:DATA]). The number of amplitudes returned is equal to the current number of display points (DISPlay:POINtcount). The query command will return a #0 if data is invalid for the active trace.

Parameter(s): <numeric_value>

:TRACe:IQ:DATA:FORMat <PACKed|ASCii>
:TRACe:IQ:DATA:FORMat?

Title: IQ Data Format

Description: This command selects the data format for transferring I/Q data via the TRACe:IQ:DATA? query. Supported data formats include PACKed, which is a binary format that includes embedded timestamps, and ASCii, which is a human-readable, comma-delimited list of samples. The PACKed format is recommended for applications that require precision timestamps, high data throughput, and processing in real time, such as TDOA. The ASCii format can be much slower to transfer, but it has the advantage of being human readable. When the data format is PACKed, TRAC:IQ:DATA? query uses SCPI standard (IEEE 488.2) definite length block data format for responses. The data format is '#AXD', where X is one or more ASCII digits specifying the number of bytes in D, and A is a single ASCII digit specifying the number of digits in X. D contains binary data. The whole 'D' part looks like 'L B', where L is an ASCII string of the form 'latitude, longitude' in decimal degrees, ' ' is a single byte newline delimiter marking the end of the GPS location component, and B is the I/Q data taken from the instrument's RAM. The binary structure of B includes timestamps embedded within the samples and is described in detail in the I/Q Data Format Description document published on the Library tab of this product's official web page (http://www.anritsu.com/en-US/Products-Solutions/Test-Measurement/Mobile-Wireless-Communications/Interference-Hunter/index.aspx). The values of the GPS latitude and longitude in the header are undefined if the GPS is not actually fixed (i.e. FETCH:GPS? returns "NO FIX"). When the data format is ASCii, TRAC:IQ:DATA? query returns an definite length block data response in Comma Separated Values (CSV) Standard File Format, which is easily imported into popular spreadsheet programs: * Each record is on

one line * Lines are separated by carriage return and line feed (CRLF) * Fields are separated by commas * Trailing and leading whitespace is insignificant * No quotes, embedded commas, or embedded newlines in this output The data format is '#AXD' where X is one or more ASCII digits specifying the number of bytes in D, and A is the number of digits in X. D contains a list of I/Q samples. Each of I and Q are formatted as signed decimal integers. Each I is separated from its corresponding Q by a comma. Adjacent samples are separated by newlines. So, the data (excluding the '#AX' header) looks like: I1,Q1 I2,Q2 I3,Q3 ... The ASCii format response contains neither time stamp nor header. To get the GPS location, see the FETCh:GPS? query.

Parameter(s): <PACKed|ASCii>

Query Return: PACK|ASC

Default Value: PACKed

:TRACe:PRESet:ALL

Title: Preset All Trace

Description: This command preset all traces which turn Traces 2-6 off and set Trace 1 to Clear/Write, Active, Peak Detector.

:TRACe:SELect <numeric_value> | DEFault | MINimum | MAXimum
:TRACe:SELect? [DEFault | MINimum | MAXimum]

Title: Select Trace

Description: The selected trace will be used by operations that use a single trace.

Query Return: Numeric

Set Command Parameter(s): <numeric_value> | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 1

Range: 1 to 1

:TRACe:STATus? <numeric_value>

Title: Trace Status

Description: This command returns a response of the same format as a valid TRACe[:DATA] response, except that instead of amplitude, each comma-delimited value is a decimal integer representing the bitwise-OR of one or more status bits. Each bit of the integer is set according to the table below to indicate that the corresponding trace point has the indicated status: Bit Decimal Value Description 0 1 ADC Overrange 1 Not Implemented Not Implemented 2 Not Implemented Not Implemented 3 8 LO1 Lock Failure 4 16 LO2 Lock Failure 5 32 TG LO Lock Failure 6 64 Limit Failure 7-31 Not Implemented Not Implemented

Parameter(s): <numeric_value>

6-24 :TRIGger Subsystem

:TRIGger[:SEQuence]:ATRigger <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum
:TRIGger[:SEQuence]:ATRigger? [DEFault | MINimum | MAXimum]

Title: Trigger Auto Period

Description: The trigger auto period is the amount of time that must pass without an trigger event before a measurement is triggered automatically.

Query Return: Numeric (ms)

Set Command Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 1000 ms

Default Unit: ms

Range: 0.001 ms to 5000 ms

:TRIGger[:SEQuence]:ATRigger:STATe <0 | 1 | ON | OFF>
:TRIGger[:SEQuence]:ATRigger:STATe?

Title: Trigger Auto State

Description: The trigger auto state indicates whether or not a measurement should be triggered automatically after the Trigger Auto Period elapses.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:TRIGger[:SEQuence]:DELay <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum
:TRIGger[:SEQuence]:DELay? [DEFault | MINimum | MAXimum]

Title: Trigger Delay

Description: The trigger delay is the amount of time between when an external trigger event happens and when the measurement starts.

Query Return: Numeric (ms)

Set Command Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 ms

Default Unit: ms

Range: -1000 ms to 1670 ms

:TRIGger[:SEQuence]:DELay:STATe <0 | 1 | ON | OFF>
:TRIGger[:SEQuence]:DELay:STATe?

Title: Trigger Delay State

Description: The trigger delay state turns trigger delay on/off.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:TRIGger[:SEQuence]:HOLDoff <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum
:TRIGger[:SEQuence]:HOLDoff? [DEFault | MINimum | MAXimum]

Title: Trigger Holdoff

Description: The trigger holdoff is the amount of time between when a measurement ends and when to start looking for the next external trigger event.

Query Return: Numeric (ms)

Set Command Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 ms

Default Unit: ms

Range: 0 ms to 5000 ms

:TRIGger[:SEQuence]:HOLDoff:STATe <0 | 1 | ON | OFF>
:TRIGger[:SEQuence]:HOLDoff:STATe?

Title: Trigger Holdoff State

Description: The trigger holdoff state turns trigger holdoff on/off.

Parameter(s): <0 | 1 | ON | OFF>

Query Return: 0 | 1

Default Value: OFF

:TRIGger[:SEQuence]:SLOPe <POSitive|NEGative|ANY>
:TRIGger[:SEQuence]:SLOPe?

Title: Trigger Slope

Description: The trigger slope indicates whether the trigger point is on the rising or the falling edge of the external trigger signal.

Parameter(s): <POSitive|NEGative|ANY>

Query Return: POS|NEG|ANY

Default Value: POSitive

:TRIGger[:SEQuence]:SOURce <EXTernal|IMMediate|VIDeo>
:TRIGger[:SEQuence]:SOURce?

Title: Trigger Source

Description: The trigger source indicates whether or not to look for a trigger condition before making measurements. VIDeo trigger is only valid for zero span operation.

Parameter(s): <EXTernal|IMMediate|VIDeo>

Query Return: EXT|IMM|VID

Default Value: IMMediate

:TRIGger[:SEQuence]:VIDeo:HYSTeresis <numeric_value> {DB} | DEFault | MINimum | MAXimum
:TRIGger[:SEQuence]:VIDeo:HYSTeresis? [DEFault | MINimum | MAXimum]

Title: Trigger Video Hysteresis

Description: A relative amplitude value in dBm centered around the video trigger level which the input signal must cross for a trigger event to occur when trigger source is set to video (TRIG:SOUR VID).

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (dB)

Set Command Parameter(s): <numeric_value> {DB} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 dB

Default Unit: dB

Range: 0 dB to 200 dB

:TRIGger[:SEQuence]:VIDeo:LEVel <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum
:TRIGger[:SEQuence]:VIDeo:LEVel? [DEFault | MINimum | MAXimum]

Title: Trigger Video Level

Description: The amplitude value in dBm which the input signal must cross for a trigger event to occur when trigger source is video (TRIG:SOUR VID).

See UNIT:POWer to query or set the current amplitude units.

Query Return: Numeric (<amplitude_units>)

Set Command Parameter(s): <numeric_value> {<amplitude_units>} | DEFault | MINimum | MAXimum

Query Command Parameter(s): [DEFault | MINimum | MAXimum]

Default Value: 0 dBm

Default Unit: dBm

Range: -150 dBm to 30 dBm

6-25 :UNIT Subsystem

This subsystem sets the default measurement units.

:UNIT:CHPower:PSDensity <DBMHz|DBMMhz>
:UNIT:CHPower:PSDensity?

Title: Power Spectral Density Units

Description: Sets the power spectral density units to be either dbm/Hz or dbm/MHz

Parameter(s): <DBMHz|DBMMhz>

Query Return: DBMH|DBMM

Default Value: DBMHz

:UNIT:POWer <DBM|DBUV>
:UNIT:POWer?

Title: Measurement Units

Description: Sets the default amplitude units for input, output and display. Available units: dBm,dBuV

Parameter(s): <DBM|DBUV>

Query Return: DBM|DBUV

Default Value: DBM

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Appendix A — Updating MS2710xA Firmware

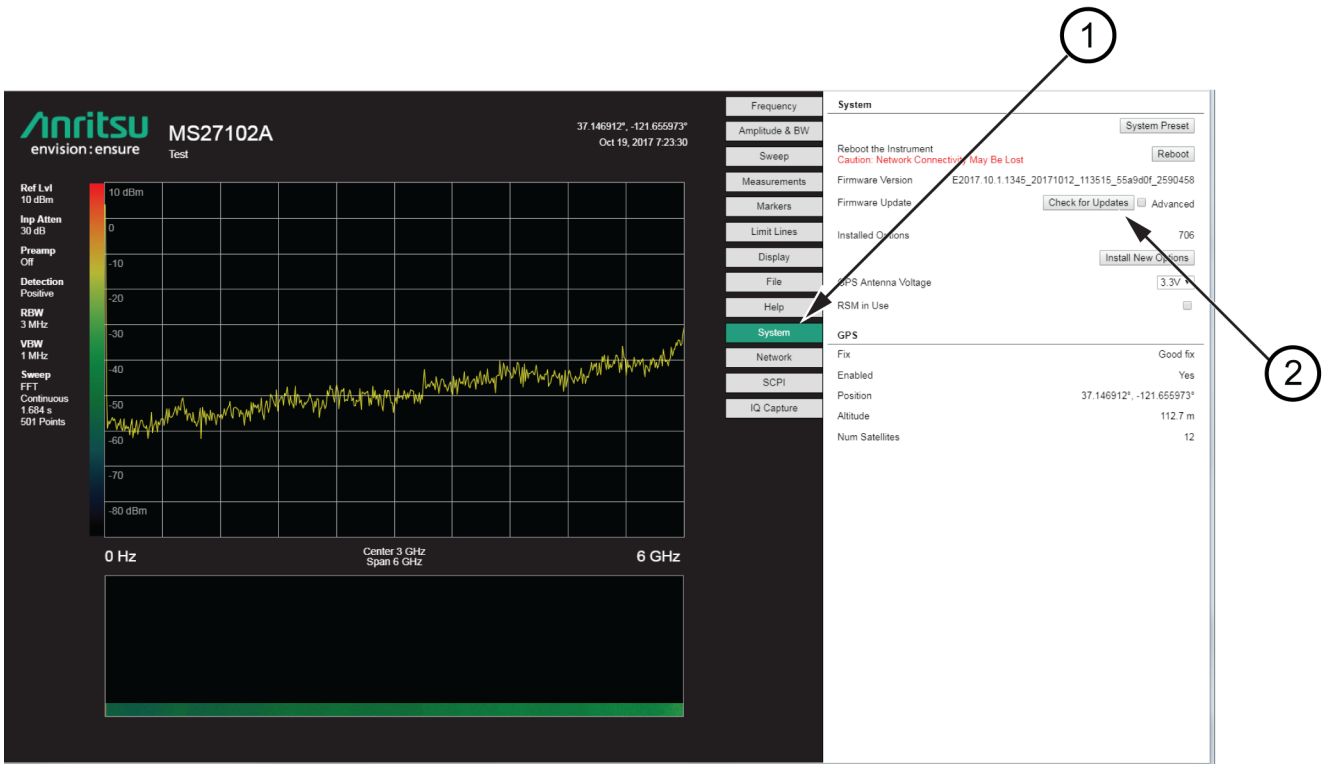
A-1 Introduction

There are several options available to upgrade MS2710XA firmware depending on the Remote Spectrum Monitor application environment.

1. When the monitor is connected to the internet, you can update to the most current firmware version by accessing the Anritsu website for a download.
2. The target monitor has a USB port available to the user (MS27100A, MS27101A, and MS27103A) and you would like to update over this connection.
3. Use an FTP process to transfer a firmware file over a LAN connection between a PC and the MS2710XA.
4. The monitor is not connected to the internet but you want to update the firmware over the LAN connection on a private network. This is similar to the auto update from the Anritsu website but the process is re-directed to a location on the private network.

Download Firmware From the Internet

Firmware Updates are available from the Internet. See Figure A-1.



1. System Button
2. Check for Updates Button

Figure A-1. Check For Updates

1. Select the System button.

2. Select the Check for Updates Button.

Either of two dialog boxes will appear. See Figure A-2.

1. Firmware Up to Date	2. Firmware Update Available

Figure A-2. Firmware Update Dialogs

If the Firmware Up to Date message appears, select Reinstall or Dismiss. By selecting Reinstall, the firmware will automatically reinstall into the MS2710xA. By selecting Dismiss, the dialog box will disappear and the display screen will be available again.

If the Firmware Update Available appears, select Install Update and the firmware will automatically install into the MS2710xA. By selecting cancel, the dialog will disappear and the display screen will be available again.

Download Firmware by the USB Port

Download firmware to a USB memory device. Go to the Anritsu web-page to download the Firmware Update for the Remote Spectrum Monitor MS2710xA here:

https://www.anritsu.com/en-US/test-measurement/support/downloads/software/dwl18782

The Download page for the MS2710xA will appear. See Figure A-3.

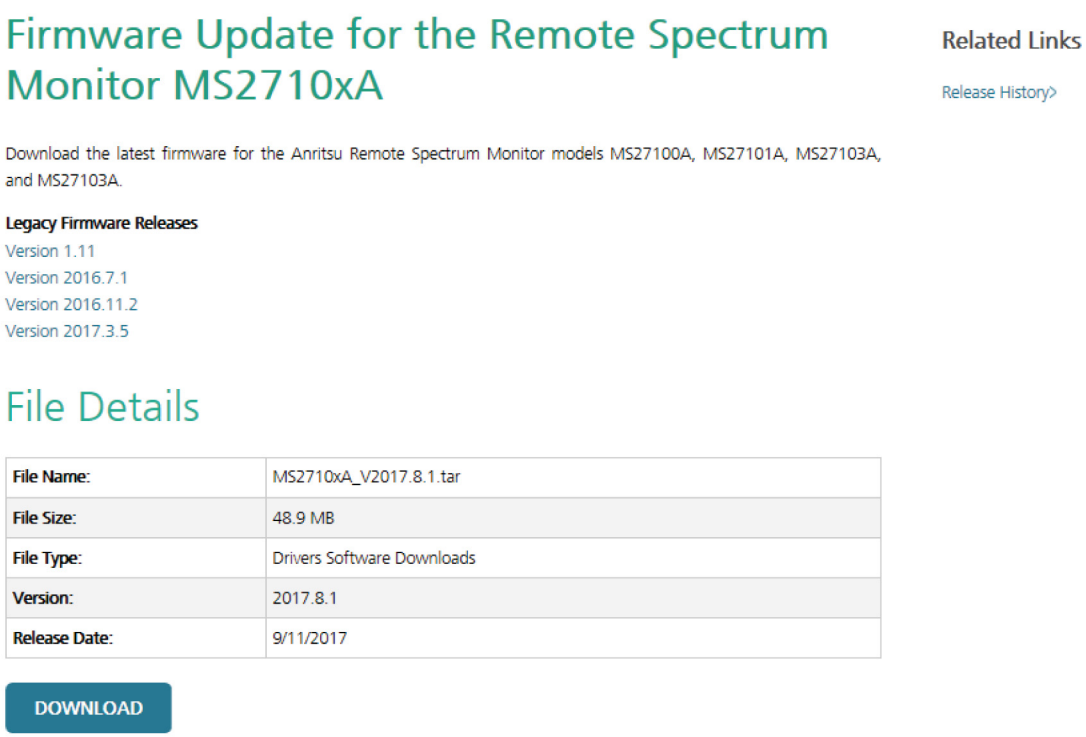


Figure A-3. Download Firmware

1. Select the Download button.
2. Copy the .tar file to the USB memory device.
3. Insert the USB in any one of the USB ports on the target MS2710XA.
   - The system will automatically update the monitor firmware. If you are using the web browser; the application will stop, updating will take approximately two minutes, and then the browser will reconnect.
4. Check under the system tab of the browser to confirm the desired firmware version is loaded.

Use an FTP Process to Update the Firmware

You can use File Transfer Protocol (FTP) to upload files from the local PC to the remote probe. There are multiple methods that can be used to enable an FTP process. Windows PCs come with a command line FTP client built in, Windows Explorer can be used as an FTP client.

Requirements

- The firmware package file that is to be installed (*.tar)
- A PC that has network access to the instrument
- An FTP client for the PC

Example

The following example uses Windows Explorer as an FTP client

Note	Windows Explorer has FTP support built-in since Windows 7.

On your keyboard, open Windows Explorer by pressing the Windows key plus E simultaneously. See Figure A-4.

Figure A-4. Open Windows Explorer

The Windows Explorer screen will appear. Enter the IP address or hostname of the remote probe you are trying to connect with. ('ftp://[probe IP or hostname]') in the Windows Explorer Ad.dress bar. See Figure A-5.

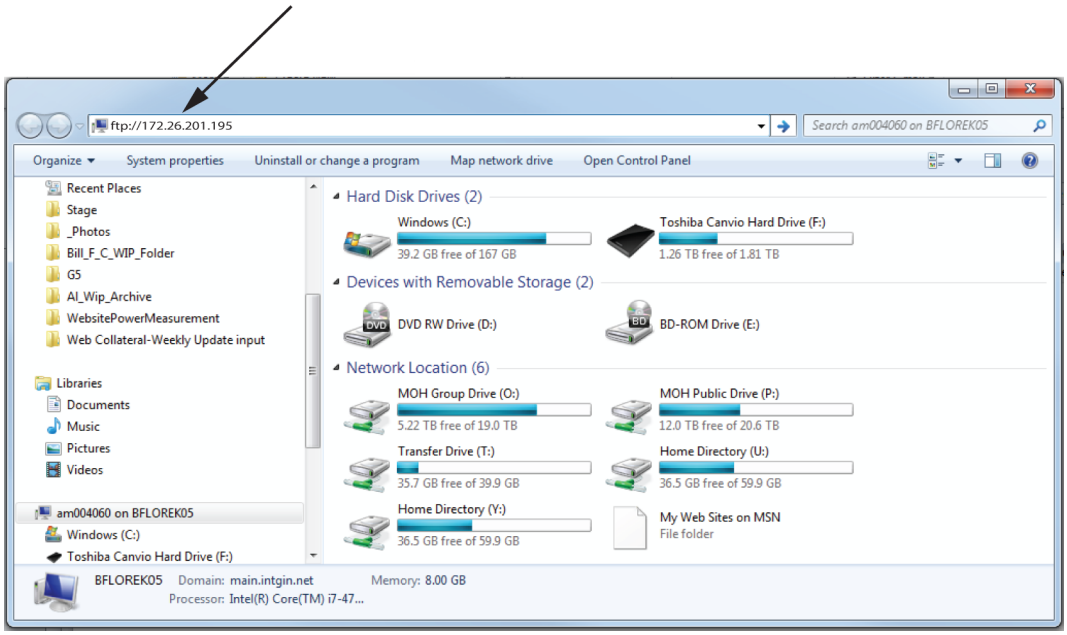


Figure A-5. Enter IP Address

In this example, the IP address entered in the Windows Explorer address bar as ftp://172.26.201.195. Once entered, a Log on As dialog box will appear. See Figure A-6.

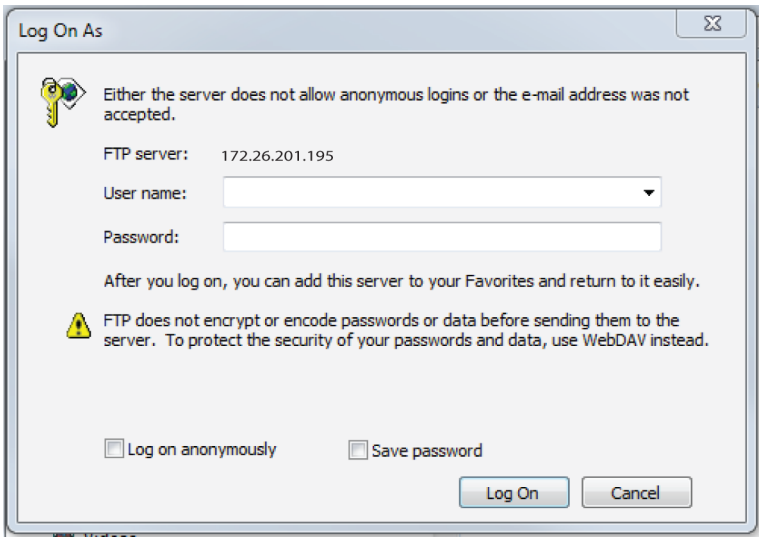


Figure A-6. Log On As Dialog Box

Enter the ftp user-name and password as prompted ('ftp' and probe serial number.) If you do not know the unit's serial number, you can find the serial number by using the *IDN? SCPI command in the SCPI panel of the Web browser interface. The Password is the target serial number.

Open the Internal folder.

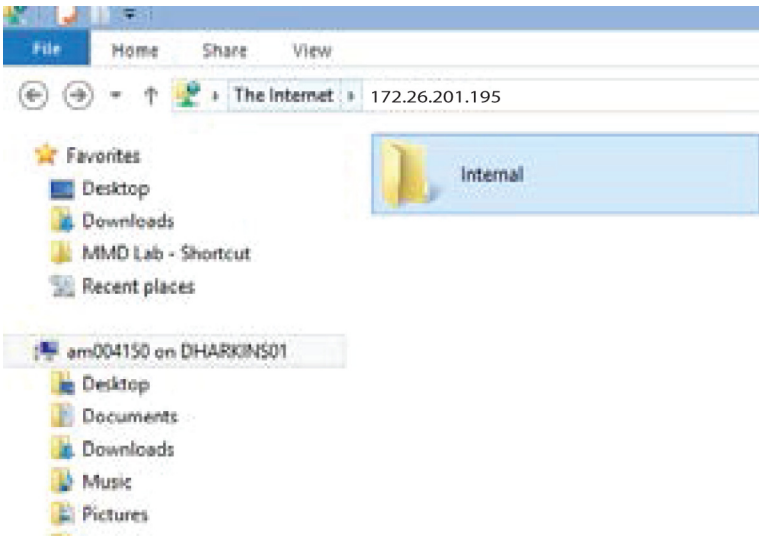


Figure A-7. Internal Folder

Copy the new firmware .tar file to the internal folder:

Use the SYST:FIRM:UPD SCPI command to install the uploaded firmware package.

1. This SCPI command requires parameters of the file name and the memory location:
   - SYST:FIRM:UPD "release-MS2710xA_T2017.3.6.tar", "Internal"
2. This will initiate the automatic update process.

Using a Server Node Process to Download Firmware

This process will simulate the automated firmware update process described in the Section "Download Firmware From the Internet" on page A-1, but will be configured to operate in a private network. This approach is accomplished by directing the remote monitors to a server location different than the Internet Anritsu web site.

Requirements

- A web (http) server accessible over port 80 on the instrument's network.
- A custom manifest file describing what firmware packages are available and where they can be downloaded from:
- The file contains JSON (JavaScript Object Notation) describing the packages; For an example, see the official, default file at: http://softwareupdates.anritsu.com/en-us/packagelist.txt.

```
{
   "default": "V2017.8.1 (MS2710xA)",
   "packages": [
      {
         "name": "V2017.8.1 (MS2710xA)",
"version": "V2017.8.1",
"model": "MS2710xA",
         "url": "http://softwareupdates.anritsu.com/en-us/MS2710xA_V2017.8.1.tar"
      }
   ],
   "version": "1.0.0"
}
```

  - For most customer use cases, it should be sufficient to start with the official file as a template and simply change the package name, version, URL of the .tar file, and the reference "default" (this will prioritize the version to be accessed).
  - The name of the manifest file does not matter (it does not need to be called packagelist.txt)
- The firmware package file that is to be installed (*.tar)

Using a Server Node Process to Download Firmware

1. Set up/configure the http server so that it can be accessed by the instrument.
2. Place the firmware package in the web server's content tree and verify it can be downloaded within the network from some other computer
   - Note the URL of the package, e.g. http://myserver/MS2710xA_V2016.11.2.tar
3. Ensure that the custom manifest file contains the correct URL for the package that was downloaded in step ii.
4. Place the custom manifest file in the web server's content tree and verify it can be downloaded within the network from some other computer
   - Note the URL of the manifest file, e.g. http://myserver/packagelist.txt
5. Send the SYST:FIRM:UPD:REM:SOUR SCPI command to the instrument to set the custom manifest file. This command will require a string parameter that is the URL for the manifest file.
6. Verify that the new firmware package source is being recognized by the instrument by either
   1. Reboot or refresh the web GUI and check in the:
      - System > Firmware Update > Advanced dropdown.
   2. Send the SYST:FIRM:UPD:REM:LIST? SCPI query to retrieve the list of available firmware packages.
7. Install the selected firmware package either through the web GUI or via the SYST:FIRM:UPD:REM SCPI command.

Appendix B — SCPI Command Listing

B-1 Introduction

This chapter contains all of the SCPI commands (required and native) that are implemented in the RSM.

The SCPI commands are grouped by their respective subsystems. For each subsystem, the commands are described in detail in the listing. The commands in this section are listed in alphabetical order.

Alphabetical Command Listing

Appendix C — SCPI Error Table

C-1 Introduction

This section lists the error code/messages returned from the device when an error occurs during the execution of the SCPI command.

Error messages are classified by error number as listed in table below.

Error Number	Error String	Description
0	No error	The queue is completely empty. Every error/event in the queue has been read or the queue was purposely cleared by power-on, `*CLS`, etc.
-100	Command error	Command error
-101	Invalid character	A syntactic element contains a character which is invalid for that type.
-102	Syntax error	An unrecognized command or data type was encountered.
-103	Invalid separator	The parser was expecting a separator and encountered an illegal character.
-104	Data type error	The parser recognized a data element different than one allowed.
-108	Parameter not allowed	More parameters were received than expected for the header.
-109	Missing parameter	Fewer parameters were received than required for the header.
-110	Command header error	An error was detected in the header.
-120	Numeric data error	Error is generated when parsing a data element which appears to be numeric, including the non-decimal numeric types.
-121	Invalid character in number	An invalid character for the data type being parsed was encountered.
-123	Exponent too large	The magnitude of the exponent was larger than 32000.
-124	Too many digits	The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros.
-131	Invalid suffix	The suffix does not follow the syntax or suffix is inappropriate for this device.
-141	Invalid character data	Either the character data element contains an invalid character or the particular element received is not valid for the header.
-160	Block data error	Error is generated when parsing a block data element.
-171	Invalid Expression	The expression data element was invalid; for example, unmatched parentheses or an illegal character.
-200	Execution error	Execution error
-213	Init ignored	Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.
-224	Illegal parameter value	Indicates that an exact value, from a list of possibles, was expected.
-230	Invalid trace data	Data corrupt or stale

Error Number	Error String	Description
-251	Missing mass storage	Indicates that a legal program command or query could not be executed because of missing mass storage.
-256	File name not found	Indicates that a legal program command or query could not be executed because the file name on the device was not found.
-300	Device-specific error	Device-specific error
-340	Calibration Failed	Calibration Failed
-350	Queue overflow	A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.
-363	Input buffer overrun	Software or hardware input buffer on incoming port overflows with data caused by improper or nonexistent pacing.
-400	Query error	Query error

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