Programming Manual

LMR Master™ S412E

An Integrated, Handheld Multi-function Land Mobile Radio Test Tool for Greater Flexibility and Technician Productivity

Note	SCPI programming commands may not be available for all instrument operating modes and functions.

Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA
http://www.anritsu.com

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Chapter 1 — General Information

1-1 About this Manual

This SCPI Programming Manual provides information for remote operation of the S412E LMR Master using commands sent from an external controller through the Ethernet or USB connection. This Programming Manual includes the following:

- An overview of the Ethernet and USB connection to the S412E
- An overview of Standard Commands for Programmable Instruments (SCPI) command structure and conventions
- The IEEE common commands that are supported by the LMR Master
- A complete listing and description of all the SCPI commands that can be used to remotely control functions of the LMR Master. These commands are organized by instrument mode starting in Chapter 3.

This manual is intended to be used in conjunction with the LMR Master S412E User Guide. Refer to that manual for general information about the LMR Master, including equipment setup and operating instructions.

1-2 Introduction

This chapter provides a general description of remote programming setup, Ethernet or USB connection, and cable requirements.

1-3 Contacting Anritsu

To contact Anritsu, please visit:
http://www.anritsu.com/contact-us

From here, you can select the latest sales, select service and support contact information in your country or region, provide online feedback, complete a “Talk to Anritsu” form to have your questions answered, or obtain other services offered by Anritsu.

Updated product information can be found on the Anritsu website:

Search for the product model number. The latest documentation is on the product page under the Library tab.

Example URL for LMR Master S412E:

http://www.anritsu.com/en-US/test-measurement/products/s412e

1-4 Remote Programming Setup and Interface

Remote programming and operation of the LMR Master is accessed via the Ethernet or USB interface. The following paragraphs provide information about the interface connections, cable requirements, and setup for remote operation.

Note	If a password has been set for the instrument, to control access via the Anritsu Web Remote Tools, for example, remote operation using SCPI commands is not possible.

Remote Access Password

Remote access to your LMR Master may be restricted. This function is valid only with Master Software Tools (MST) v2.21.1 or later. The purpose of the password is to protect the LMR Master from unauthorized access when it is connected to the Internet.

After setting the password from the front panel of the instrument, reboot the instrument (normal power OFF then ON) to provide remote access security. Only one user then has remote access at any one time.

The password is first set into the instrument, then used via Master Software Tools. When prompted in MST, enter the password into the password text box.

Ethernet Interface Connection and Setup

The S412E fully supports the IEEE-802.3 standard. Most S412E 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 S412E 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:

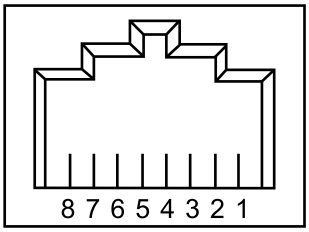
- IP Address: Every computer and electronic device in a TCP/IP network requires an IP address. An IP address has four numbers (each between 0 and 255) separated by periods. For example: 128.111.122.42 is a valid IP address.
- Subnet Mask: The subnet mask distinguishes the portion of the IP address that 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 LMR Master 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. A pinout diagram is shown in Table 1-1.

Table 1-1. 8-pin Ethernet RJ45 Connector Pinout Diagram



Pin	Name	Description	Wire Color
1	TX+	Transmit data (> +3 volts)	White/Orange
2	TX–	Transmit data (< –3 volts)	Orange
3	RX+	Receive data (> +3 volts)	White/Green
4	–	Not used (common mode termination)	Blue
5	–	Not used (common mode termination)	White/Blue
6	RX–	Receive data (< –3 volts)	Green
7	–	Not used (common mode termination)	White/Brown
8	–	Not used (common mode termination)	Brown

TCP/IP connectivity requires setting up the parameters described at the beginning of this section. The following is a brief overview of how to set up a general LAN connection on the S412E.

Note	You may need to consult your network documentation or network administrator for assistance in configuring your network setup.

LMR Master LAN Connections

The RJ45 connector is used to connect the LMR Master to a local area network. Integrated into this connector are two LEDs. The amber LED indicates the presence of LAN voltages (a live LAN connection) while the green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (8) key followed by the System Options soft key and the Ethernet Config soft key. The instrument IP address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address and subnet mask.

Note	An active Ethernet cable must be connected to the LMR Master before it is turned ON in order to enable the Ethernet port for DHCP or for a static IP address. Depending upon local conditions, the port may remain enabled when changing from DHCP to static IP address, when changing from static IP address to DHCP, or when temporarily disconnecting the Ethernet cable. If the port becomes disabled, ensure that an active Ethernet cable is attached to the LMR Master and then cycle the power OFF and back ON.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the LMR Master to the network and select DHCP protocol in the Ethernet Config menu.

Power cycle the LMR Master. If the network is set up for DHCP, then the assigned IP address should be displayed briefly after the power-up sequence.

To display the IP address of the instrument, press the **Shift** key, then the **System** (8) key, then the System Options soft key and the Ethernet Config soft key.

USB Interface Connection and Setup

Note	For proper detection, Master Software Tools must be installed on the PC prior to connecting to the S412E using the USB port. Master Software Tools provides the installation tools to install the USB and VISA drivers.

The Universal Serial Bus (USB) architecture is a high-performance networking standard that is considered “plug and play” compatible. The USB driver software is automatically detected and configured by the operating system of the devices that are connected to the bus. The S412E conforms to the USB 2.0 standard and is a USB “full-speed” device that supports data rates of up to 10 Mbps with the following restrictions:

- One USB network can support up to 127 devices
- The maximum length of USB cables between active devices is 5 meters (for USB 2.0) and 3 meters (for USB 1.0)

To run the following example, you must have NI-VISA 2.5 or later installed on the controller PC, and you must select the VISA library (visa32.dll) as a reference in a Visual Basic project. For remote USB control, the controlling PC needs to have a version of VISA installed that supports USBTMC (USB Test and Measurement Class) devices.

1. Turn On power to the S412E and controller PC and wait for the systems to power up completely.
2. Connect the USB cable mini-B connector to the S412E.
3. Connect the USB cable A connector to the controller PC USB host port. The controller PC should indicate "New Hardware Found" if the combination of USB VID/PID/ Serial Number has never been connected to this controller PC.

Figure 1-1. USB Found New Hardware Wizard

4. Select to allow the Wizard to search for and install the USB software automatically.

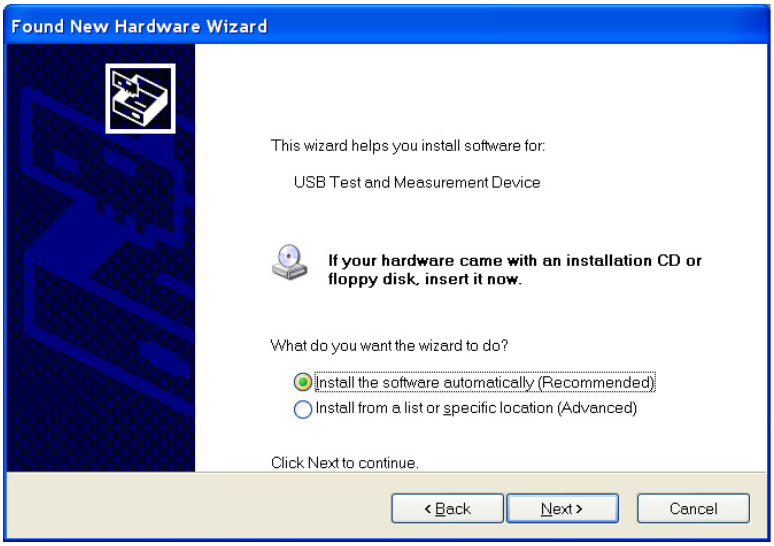


Figure 1-2. USB Found New Hardware Wizard

5. After the software is installed, close the Wizard by clicking Finish.

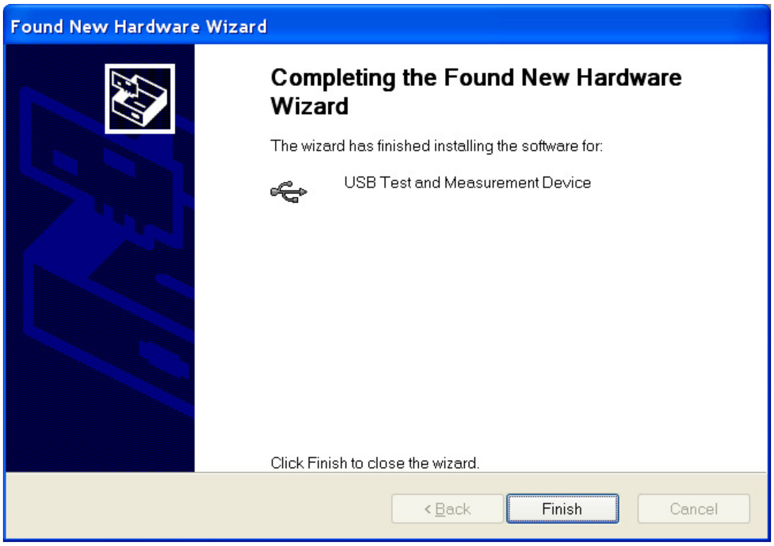


Figure 1-3. USB Found New Hardware Wizard

USB Interface, Type Mini-B

The USB 2.0 Mini-B device connector can be used to connect the S412E directly to a PC. The first time that the S412E is connected to a PC, the normal USB device detection is performed by the computer operating system. The CD-ROM that is shipped with the instrument contains a driver for Windows 2000, Windows XP, and Windows Vista. The driver is installed when Master Software Tools is installed. Drivers are not available for earlier versions of the Windows operating system. During the driver installation process, place the CD-ROM in the computer drive and specify that the installation wizard should search the CD-ROM for the driver.

1-5 Sending SCPI Commands

SCPI commands can be sent to the LMR Master though any Virtual Instrument Software Architecture (VISA) controller. VISA is a commonly-used API in the Test and Measurement industry for communicating with instruments from a PC. The physical connection between the PC and the LMR Master can be Ethernet or USB.

NI-VISA is the National Instruments implementation of the VISA I/O standard. Information and downloads are available at the following link:

http://www.ni.com/visa/

The following example describes the verification that a VISA controller can detect the LMR Master. The images shown and the instructions for your instrument and software may differ from the examples in this manual.

Note	Before remote operation, confirm that the instrument is not in the Menu screen. Sending commands while this screen is displayed is an invalid operation. Refer to the instrument User Guide for information on the Menu screen.

1. On the PC, run VISA Interactive Control and double click on the LMR Master.

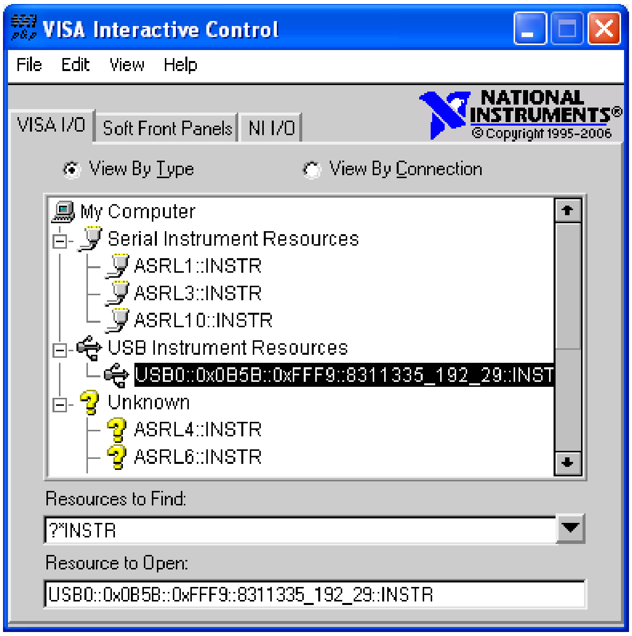


Figure 1-4. VISA Interactive Control

2. Select the viWrite tab and execute the default *IDN? write by clicking the Execute button.

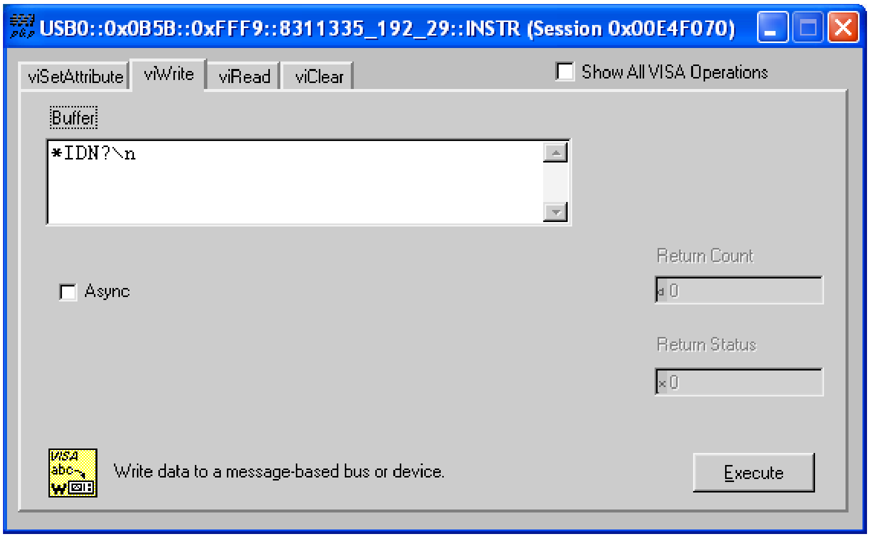


Figure 1-5. VISA Interactive Control viWrite Tab

3. Select the viRead tab and click the Execute button. If the PC is connected to the LMR Master, then the command returns the following information from the Buffer: manufacturer name ("Anritsu"), model number/options, serial number, and firmware package number.

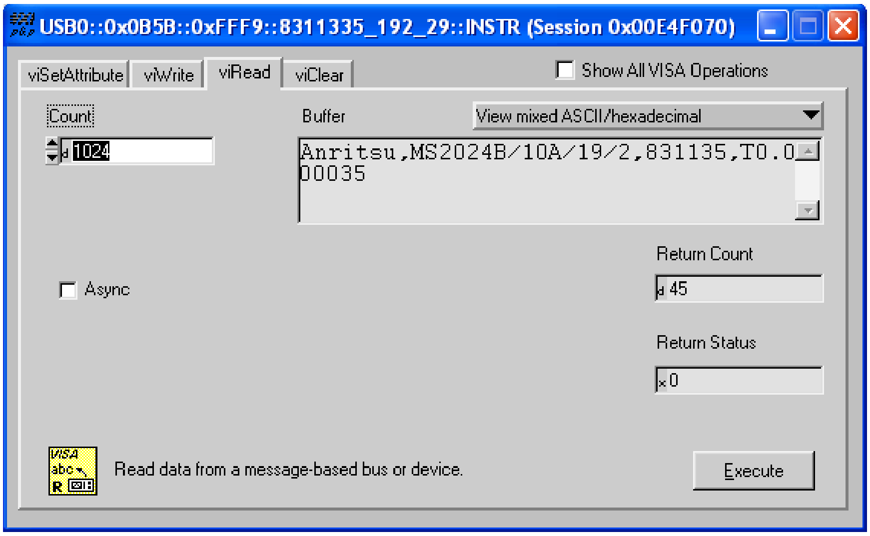


Figure 1-6. VISA Interactive Control viRead Tab

Chapter 2 — Programming with SCPI

2-1 Introduction

This chapter provides an introduction to SCPI programming that includes descriptions of the command types, hierarchical command structure, command subsystems, data parameters, and notational conventions.

2-2 Introduction to SCPI Programming

The Standard Commands for Programmable Instruments (SCPI) defines a set of standard programming commands for use by all SCPI-compatible instruments. SCPI is intended to give the user a consistent environment for program development. It does so by defining controller messages, instrument responses, and message formats for all SCPI-compatible instruments. SCPI commands are messages to the instrument to perform specific tasks. The S412E command set includes:

- "SCPI Common Commands" on page 2-2
- "SCPI Required Commands" on page 2-3
- "SCPI Optional Commands" on page 2-3

Caution	Programs that receive SCPI commands may require support for Extended ASCII character codes in order to display some of the returned characters, such as Greek letter mu (μ). Some commands, for example, return the units of time in microseconds (μs). In this Anritsu programming manual, the Greek letter mu is represented by the English letter "u" to avoid typographic problems during publication.

Note	The S412E follows the SCPI standard but is not fully compliant with that standard. The main reason that S412E is not fully compliant is because it does not support all of the required SCPI commands, and because it uses some exceptions in the use of short form and long form command syntax. SCRE for SCREen and TYP for TYPE are two examples of the command short forms that are used in S412E in order to be compatible with older products.

2-3 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. The common commands that are supported by the S412E are shown below.

*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 appear as follows:

`"Anritsu,MS2028B/10/2,62011032,1.23"`

*RST

Title: Reset

Description: This command restores parameters in the current application as well as system settings to their factory default values.

System settings that are affected by this command are Ethernet configuration, language, volume, and brightness. Note that the unit will power cycle after this command is executed.

Front Panel Access: Shift-8 (System), System Options, Reset, Factory Defaults

See Also: `:SYSTem:PRESet`

Note	The best practice when starting any remote program is to reset the instrument to a known state. This is especially important when the instrument is being used in both remote and front-panel operation. Use the ***RST** or the **:SYSTem:PRESet** command to restore the instrument to the factory default settings. Operating the instrument through the front panel and remotely at the same time could, under certain conditions, cause the instrument to hang up. To avoid conflicts, do not combine front panel operation and remote operation.

2-4 SCPI Required Commands

The required SCPI commands that are supported by the S412E are listed in the Table 2-1. These commands work in all measurement modes and are described in Chapter 3.

Table 2-1. SCPI Required Commands

:STATus
:SYSTem

2-5 SCPI Optional Commands

Table 2-2 lists the optional SCPI commands that comprise the majority of the command set that is described in this document. These commands control most of the programmable functions of the S412E.

Table 2-2. SCPI Optional Commands

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

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

- Chapter 3, "All Mode Commands"
- Chapter 4, "Spectrum Analyzer Commands"
- Chapter 5, "VNA Commands"
- Chapter 6, "Vector Voltmeter Commands"
- Chapter 7, "Fixed WiMAX Commands"
- Chapter 8, "Mobile WiMAX Commands"
- Chapter 10, "P25 Phase 1 Commands"
- Chapter 11, "P25 Phase 2 Commands"
- Chapter 12, "NXDN Commands"
- Chapter 13, "dPMR Commands"
- Chapter 14, "DMR 2 Commands"
- Chapter 15, "PTC Commands"
- Chapter 16, "NBFM Commands"
- Chapter 17, "TETRA Commands"
- Chapter 18, "AM/FM/PM Commands"

2-6 Subsystem Commands

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

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

- The command name ("Command Names" on page 2-4).
- The path from the subsystem root command ("Hierarchical Command Structure" on page 2-5).
- The query form of the command (if applicable) ("Query Commands" on page 2-6).
- The command title.
- A description of the purpose of the command.
- The data parameters that are used as arguments for the command (described in Section "Data Parameters" on page 2-8). 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 UPPERCASE and lowercase characters. Except for common commands, each keyword has a long form and a short form.

In this manual, the long form is presented with the short form portion in UPPERCASE and the remainder in lowercase. For example, the long form of the command keyword to control the instrument display is `:DISPlay`, and the short form is `:DISP`.

The short form keyword is usually the first four characters of the long form (example: `:CALC` for `:CALCulate`). 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 is not included in a command, then the first option is implied. Braces (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 versus 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:STAR` is not an acceptable form of the command because `:FREQuen` is neither the short form nor the entire 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 that is 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 S412E SCPI command set are shown in Figure 2-1.

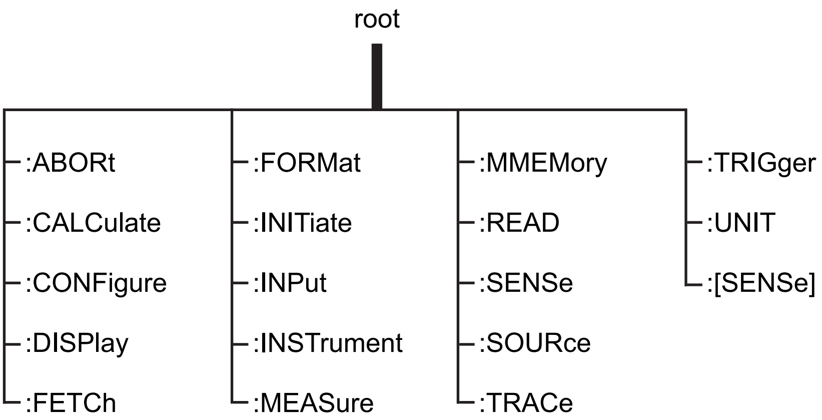


Figure 2-1. SCPI Command Tree Example

All S412E 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. The `:DISPlay` command subsystem is shown in Figure 2-2.

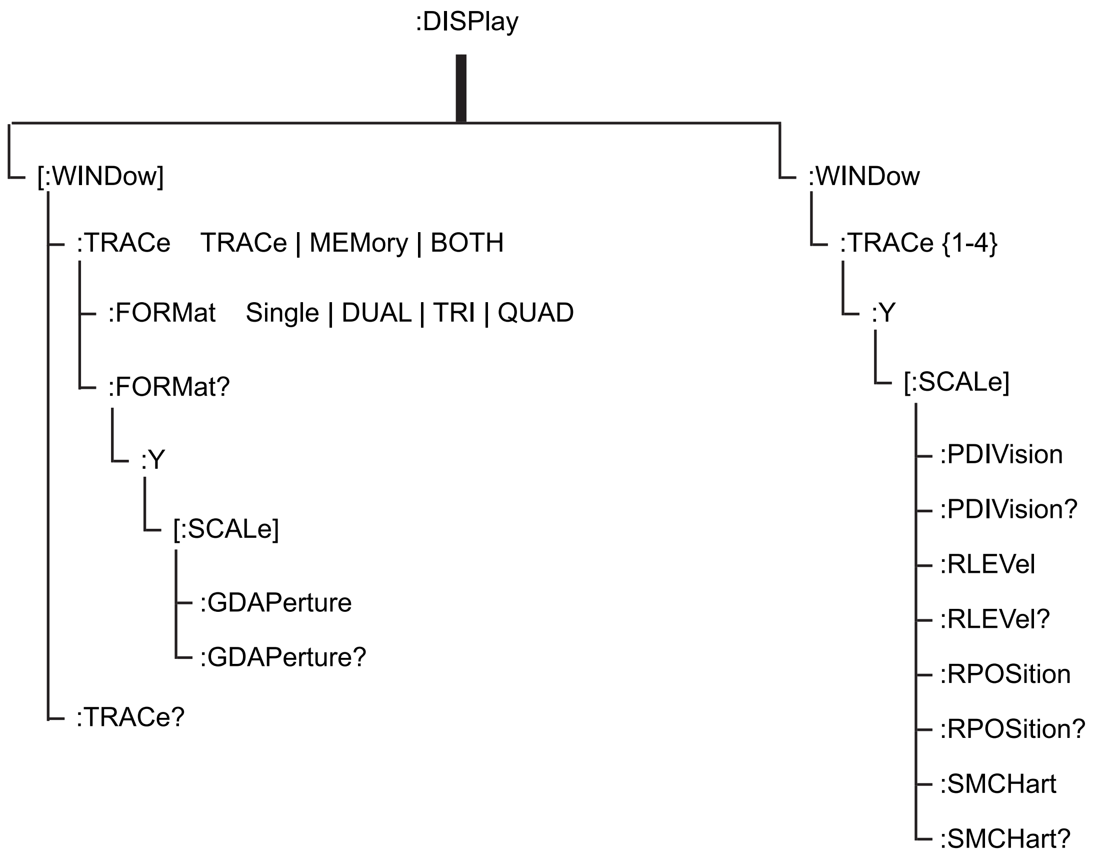


Figure 2-2. SCPI :DISPlay Subsystem Example

A colon (:) separates each subsystem. For example, the command `:DISPlay:WINDow:Trace MEMory` sets the window to display memory trace. Trace is part of the `:WINDow` subsystem, which is part of the `:DISPlay` subsystem. Y is also part of the `:DISPlay:WINDow:Trace{1-4}` subsystem.

Query Commands

As defined in IEEE-488.2, a query is a command with a question mark symbol appended (examples: `*IDN?` and `:TRACe[:DATA]? [1]|2|3|4)`. When a query form of a command is received, the current setting that is associated with the command is placed in the output buffer. Query commands usually return the short form of the parameter. Boolean values are returned as `1` or `0`, even when they can be set as `on` or `off`.

Identifiers

Some or all of 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 2-3. Description of Command Indentifiers

Identifier	Description
<amplitude>	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.
<percentage>	Percentage value from 0 to 100. Units are always %.
<rel ampl>	Relative amplitude. Units are always dB.
<x-parameter>	Parameter value in the units of the x-axis. Units are specified with the command.
<string>	The string should be enclosed in either single quotes (‘ ’) or double quotes (“ ”).
<file name>	The name should be enclosed in either single quotes (‘ ’) or double quotes (“ ”). The need for an extension is documented with applicable commands.
<voltage>	Voltage. Units specified with the command.
<current>	Current. Units specified with the command.

Data Parameters

Data parameters, referred to simply as "parameters," are the quantitative values that are used as arguments for the command keywords. The parameter type that is associated with a particular SCPI command is determined by the type of information that is 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 that is 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" on page 2-9. Parameters that accept all three `<NR>` formats are designated `<NRf>` throughout this document.

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 2-4. 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 an exponent (for example, 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 surrounded by double quotes For example: "OFF"
`<block>`	::=IEEE-488.2 block data format
`<NA>`	::=Not Applicable

Unit Suffixes

Unit suffixes are not required for data parameters, provided the values are scaled for the global default units. The S412E SCPI default units are: Hz (Hertz) for frequency-related parameters, s (seconds) for time-related parameters, and m (meters) for distance-related parameters.

If the command accepts a terminator, then the following are the available unit choices:

- `<freq>` accepts `GHZ` (Giga Hertz), `MHZ` or `MAHZ` (Mega Hertz), `KHZ` (Kilo Hertz), `HZ` (Hertz)
- `<time>` accepts `PS` (picosecond), `NS` (nanosecond), `US` (microsecond), `MS` (millisecond), `S` (Second)
- `<distance>` in meters accepts `MM` (millimeter), `M` (meter)
- `<distance>` in feet accepts `FT` (feet)

2-7 Notational Conventions

The SCPI interface standardizes command syntax and style to simplify 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 2-5. Notational Conventions

<table>
<tr><td>:</td><td>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 2-11).</td></tr>
<tr><td>;</td><td>A semicolon separates commands if multiple commands are placed on a single program line.</td></tr>
<tr><td>[ ]</td><td>Square brackets enclose one or more optional keywords.</td></tr>
<tr><td>{ }</td><td>Braces enclose one or more keyword or command parameters that may be included one or more times.</td></tr>
<tr><td>|</td><td>A vertical bar indicates “or” and is used to separate alternative parameter options.
Example: ON | OFF is the same as ON or OFF.</td></tr>
<tr><td>< ></td><td>Angle brackets enclose parameter descriptions.</td></tr>
<tr><td>::=</td><td>Means “is defined as”. For example: <a>::=<b><c> indicates that <b><c> can replace <a>.</td></tr>
<tr><td>sp</td><td>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.</td></tr>
<tr><td>XXX</td><td>Indicates a root command name.</td></tr>
</table>

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

2-8 Notational Examples

Table 2-6. Creating Valid Commands

<table>
<tr><th>Command Specification</th><th>Valid Forms</th></tr>
<tr><td>[:SENSe]:FREQuency:STARt <freq></td><td>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</td></tr>
<tr><td>:CALCulate:MARKer{1|2|3|4|5|6}:X <x-parameter></td><td>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</td></tr>
<tr><td>:UNIT:POWer DBM|DBV|DBMV|DBUV|V|W</td><td>The following commands are identical:
:UNIT:POWer DBM
:unit:pow dbm</td></tr>
<tr><td>:INITiate:CONTinuous OFF|ON|0|1</td><td>The following commands are identical:
:INITiate:CONTinuous OFF
:init:cont 0</td></tr>
</table>

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. It is good practice, however, 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 is 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. The use of a command terminator resets the command path to the root of the tree.

2-9 Formatting Conventions

This manual uses the following conventions in describing SCPI commands.

Table 2-7. Formatting Conventions

<table>
<tr><td><code>:COMMands:LOOK:LIKE:THIS</code></td><td>Commands are formatted to differentiate them from their description.</td></tr>
<tr><td><code>:COMMand:QUERies:LOOK:LIKE:THIS?</code></td><td>The query form of the command is followed by a “?”</td></tr>
<tr><td>Front panel key sequences use this formatting.</td><td>Front panel key presses are formatted to differentiate them from text descriptions. Key presses are separated by a comma (“,”).</td></tr>
<tr><td><code><identifier></code></td><td>Identifiers are enclosed in angular brackets, “< >”. They indicate that some type of data must be provided. Refer to Table 2-3 on page 2-7 for details on the types of identifiers.</td></tr>
<tr><td>|</td><td>The pipe (or vertical bar), “|” indicates that a choice must be made.</td></tr>
<tr><td><code>[optional input]</code></td><td>Optional input is enclosed in square brackets, “[ ]”. The “[ ]” are not part of the command.</td></tr>
</table>

2-10 Parameter Names

The parameters that are returned depend on the firmware version in the S412E, and this document does not cover all possible parameter values that can be returned by the command. Parameter names are dependent upon individual applications and are different for each application. They can be extracted via a Trace Preamble command.

The following tables list the parameter options for the `:TRACe:PREamble?` command in each supported measurement mode:

LMR Master, refer to:

- Table 5-3, “Trace Header Parameters” on page 5-54.
- Table 5-4, “Trace Header Marker Parameters” on page 5-62
- Table 5-5, “Trace Header Limits Parameters” on page 5-63

Vector Voltmeter, refer to Table 6-2, “Trace Header Parameters” on page 6-7.
Spectrum Analyzer, refer to Table 4-1, “Available Parameters in Spectrum Analyzer Mode” on page 4-38.
Fixed and Mobile WiMAX, refer to Table 7-1, “Available Parameters in WiMAX and Mobile WiMAX Mode” on page 7-22.
P25, refer to Table 10-1, “Returned Parameter Values in Trace Preamble” on page 10-24.
P25p2, refer to Table 11-1, “Returned Parameter Values in Trace Preamble” on page 11-27.
NXDN, refer to Table 12-1, “Returned Parameter Values in Trace Preamble” on page 12-24.
dPMR, refer to Table 13-1, “Returned Parameter Values in Trace Preamble” on page 13-23.
DMR 2, refer to Table 14-1, “Returned Parameter Values in Trace Preamble” on page 14-30.
PTC, refer to Table 15-1, “Returned Parameter Values in Trace Preamble” on page 15-28.
NBFM, refer to Table 16-1, “Returned Parameter Values in Trace Preamble” on page 16-31.
TETRA, refer to Table 17-1, “Returned Parameter Values in Trace Preamble” on page 17-23.

Chapter 3 — All Mode Commands

3-1 Introduction

The commands that are listed in this chapter are functional in all modes of operation.

3-2 :FETCh GPS Subsystem

Use this command to get GPS information.

`:FETCh:GPS?`

Title: Fetch GPS Information

Description: Returns the GPS fix status, UTC timing information, and the GPS location. The results are returned as a set of comma-delimited values in the following format:

`<fix status>, <date/time>, <latitude>, <longitude>`

The `<fix status>` field is either `"GOOD FIX"` or `"NO FIX"`, depending whether the GPS receiver is currently calculating position data. If `"NO FIX"` is the value of the `<fix status>` field, then no data follows.

The date and time (`<date/time>` field) are returned in the following format:

`Www Mmm dd hh:mm:ss yyyy`

Where `Www` is the weekday in letters, `Mmm` is the month in letters, `dd` is the day of the month, `hh:mm:ss` is the time (24-hour time), and `yyyy` is the year.

Both `<latitude>` and `<longitude>` fields are expressed in radians. A negative latitude value corresponds to a “south” reading. A negative longitude value corresponds to a “west” reading.

Related Command: `:SENSe:GPS`

Front Panel Access: Shift-8 (System), GPS, GPS Info

3-3 :INSTrument Subsystem

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

:INSTrument:CATalog:FULL?

Title: Query Available Modes

Description: Returns a comma-separated list of available modes. Mode names are enclosed in double quotes (“ ”). The application number immediately follows the string name. For example: `“HI_PM”10,”MWVNA”26`

Cmd Parameter: **NA** (query only)

Query Response: **NA** (comma separated list)

Front Panel Access: **Shift-9** (Mode) or **Menu**

:INSTrument:NSELect <integer>
:INSTrument:NSELect?

Title: Select Mode by Number

Description: Sets the instrument mode based on the value of `<integer>`. The query version returns the number that is associated with the current mode. Use `:INSTrument:CATalog:FULL?` to get a list of available mode names and their integer representations.

Note	Switching modes can take longer than 80 seconds, depending on the application. Add a delay of at least 90 seconds between mode switch commands. Anritsu Company advises you to set the remote PC time-out to 120 seconds in order to avoid unexpected time-out errors.

Cmd Parameter: `<NR1> (integer)`

```
 1 = SPA (Spectrum Analyzer mode)
10 = HI_PM (High Accuracy Power Meter mode)
18 = WIMAX_D (Fixed WiMAX mode)
19 = WIMAX_E (Mobile WiMAX mode)
26 = MWVNA (Microwave LMR Master mode)
29 = LTE (LTE Analyzer mode)
37 = P25 (P25 Analyzer mode)
44 = P25_2 (P25 Phase 2 Analyzer mode)
38 = NXDN (NXDN Analyzer mode)
50 = dPMR Signal Analyze
41 = DMR_2 (DMR 2 Analyzer mode)
```

```
 42 = PTC (PTC Analyzer mode)
 43 = NBFM (NBFM Analyzer mode)
 45 = TETRA (TETRA Analyzer mode)
  6 = PM (Power Meter mode)
 30 = AMFMPM (AM/FM/PM Analyzer mode)
 15 = CS (Channel Scanner mode)
 14 = IA (Interference Analyzer mode)
 22 = CWSG (CW Signal Generator mode)
102 = VVM (Vector Voltmeter mode)
```

Related Command: `:INSTrument:CATalog:FULL?`
`:INSTrument[:SELect]`
`:STATus:OPERation?`

Front Panel Access: **Shift-9 (Mode)** or **Menu**

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

Title: Select Mode by Name

Description: Sets the instrument mode based on the mode name that is specified by `<string>`. The query version returns the name of the current mode. Use `:INSTrument:CATalog:FULL?` to get a list of available modes. For example, for Vector Voltmeter, use `"VVM"`.

Cmd Parameter: `<string>`
`SPA|HI_PM|WIMAX_D|WIMAX_E|MWVNA|LTE|P25|P25_2|NXDN|DPMR|DMR_2|PTC|NBFM|TETRA|PM|AMFMPM|CS|IA|CWSG|VVM`

`SPA` = Spectrum Analyzer mode
`HI_PM` = High Accuracy Power Meter mode
`WIMAX_D` = Fixed WiMAX mode
`WIMAX_E` = Mobile WiMAX mode
`MWVNA` = Microwave LMR Master mode
`LTE` = LTE Analyzer mode
`P25` = P25 Analyzer mode
`P25_2` = P25 Phase 2 Analyzer mode
`NXDN` = NXDN Analyzer mode
`DPMR` = dPMR Analyzer mode
`DMR_2` = DMR 2 Analyzer mode

`PTC` = PTC Analyzer mode
`NBFM` = NBFM Analyzer mode
`TETRA` = TETRA Analyzer mode
`PM` = Power Meter mode
`AMFMPM` = AM/FM/PM Analyzer mode
`CS` = Channel Scanner mode
`IA` = Interference Analyzer mode
`CWSG` = CW Signal Generator mode
`VVM` = Vector Voltmeter mode

Related Command: `:INSTrument:CATalog:FULL?`
`:INSTrument:NSELect`

Front Panel Access: **Shift-9 (Mode)** or **Menu**

3-4 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument setup and data storage.

:MMEMory:DATA? <file name>

Title: Transfer Data

Description: Transfers the data stored in the given file from the instrument to the controlling program. Data is transferred in the form of `<header><block>`. The ASCII `<header>` specifies the number of data bytes. It appears as `#AX`, where `A` is the number of digits in X, and `X` is the number of bytes in `<block>`.

`<file name>` should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should contain a file extension (`.jpg`, for example). The file must not be larger than 524288 bytes. Use the command `:MMEMory:MSIS` to set the current save location.

Cmd Parameter: **NA** (query only)

Query Response: `<string> <file name>`

Related Command: `:MMEMory:MSIS INTernal|USB`

Front Panel Access: **NA**

:MMEMory:DELete <file name>

Title: Delete Setup/Measurement

Description: Removes the measurement or setup file specified by `<file name>` from the current mass storage device. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”). It should contain one of the following file extensions:

File name extensions:

“`.stp`” for Setup
“`.spa`” for SPA measurement
“`.mna`” for VNA and VVM measurements
“`.hipm`” for HiPM measurements.
“`.pm`” for PM measurements.
“`.cwsg`” for CWSG measurements.
“`.afp`” for AM/FM/PM measurements
“`.ia`” for Interference Analysis measurements
“`.cs`” for Channel Scanner measurements
“`.wmxd`” for WiMAX
“`.wmxe`” for Mobile WiMAX

"`.lte`" for LTE Analyzer measurements
"`.p25`" for P25 Analyzer measurements
"`.p252`" for P25p2 Analyzer measurements
"`.nxdn`" for NXDN Analyzer measurements
"`.dpmr`" for dPMR Analyzer measurements
"`.dmr2`" for DMR 2 Analyzer measurements
"`.ptc`" for PTC Analyzer measurements
"`.nbfm`" for NBFM Analyzer measurements
"`.tetra`" for TETRA Analyzer measurements

Use the command `MMEMory:MSIS` to set the save location.

Cmd Parameter: `<file name>`

Query Response: **NA** (no query)

Front Panel Access: **Shift-7 (File**), Delete, Select or De-Select, Delete

:MMEMory:MSIS INTernal|USB
:MMEMory:MSIS?

Title: Save Location

Description: Sets the instrument's internal memory or the USB Flash drive as the save location for all subsequently saved files. This command also determines the destination location for copied files. For example, selecting internal memory as the current save location will set the USB Flash drive as the destination for copied files, and vice-versa.

Note that the save location specified here applies to remote operation. It is independent of and can be different from the save location set via the instrument front panel. The query form of this command returns the save location setting for remote operation, not the front panel setting.

Commands to load, store (save), or copy data will fail if the save location selected is the USB drive and no USB device is plugged into the instrument.

Before setting the save location, send the :SYSTem:MSIS? USB command to query the ready state of the USB Flash drive.

Cmd Parameter: INTernal|USB

Query Response: INT|USB

Parameter Type: <char>

Related Command: `:MMEMory:MSIS:DESTination`
`:SYSTem:MSIS[:STATe]?`

Front Panel Access: **Shift-7 (File)**, Save, Change Save Location, (select drive or folder)

:MMEMory:MSIS:COPY

Title: Copy from Current Save Location to Destination

Description: Copies all files and folders from the current save location to the destination. File hierarchy is maintained. In remote operation, files can only be copied from internal memory to the USB device or from USB to internal memory. If you wish to copy to the same memory device or copy specific files and folders, use the instrument front panel.

The Copy command will not execute if no USB device is plugged in. Before copying files, send the :SYSTem:MSIS? USB command to query the ready state of the USB Flash drive.

Related Command: `:MMEMory:MSIS`
`:MMEMory:MSIS:DESTination`
`:SYSTem:MSIS[:STATe]?`

Front Panel Access: **Shift-7 (File)**, Copy

:MMEMory:MSIS:DESTination INTernal|USB
:MMEMory:MSIS:DESTination?

Title: Destination of Copied Files

Description: Sets the destination location for files copied with the :MMEMory:MSIS:COPY command. Files and folders will be placed at the root level of the specified memory device. The Destination command also sets the current save location. For example, selecting the USB Flash drive as the destination will set the instrument’s internal memory as the current save location, and vice-versa.

The destination location specified by SCPI command applies to remote operation. It is independent of and can be different from the destination selected using the instrument front panel. The query form of this command returns the destination location setting for remote operation, not the front panel setting.

This command is ineffective if the specified destination is not available, such as having no USB device plugged into the USB port. Before setting the destination location, send the :SYSTem:MSIS? USB command to query the ready state of the USB drive.

Cmd Parameter: INTernal|USB

Query Response: INT|USB

Parameter Type: <char>

Related Command: `:MMEMory:MSIS`
`:MMEMory:MSIS:COPY`
`:SYSTem:MSIS[:STATe]?`

Front Panel Access: **Shift-7 (File)**, Copy, (select drive or folder under Select Destination)

:MMEMory:STORe:JPEG <file name>

Title: Save Screen as JPEG

Description: Saves the current screen measurement as a JPEG file, which is specified by <file name> with the extension `*.jpg` to the current save location. `<file name>` should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command `:MMEMory:MSIS` to set the current save location.

Cmd Parameter: `<string> <file name>`

Query Response: **NA** (no query)

Example: To save the screen into the file named “trace”.

`:MMEMory:STORe:JPEG “trace”`

Related Command: `:MMEMory:DATA?`
`:MMEMory:MSIS:INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Save

3-5 :STATus Subsystem

The commands in this subsystem relate to the current operating state of the instrument.

:STATus:OPERation?

Title: Query 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 will be 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	Not implemented
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

Cmd Parameter: **NA** (query only)

Query Response: `<decimal> (0 to 15 bit)`

Front Panel Access: **NA**

3-6 :SYSTem Subsystem

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

:SYSTem:MSIS[:STATe]? INTernal|USB

Title: Query Memory State

Description: Queries the ready state of the instrument's internal memory or of the USB Flash drive. Use this command to check the ready state of the memory device before sending a command, such as :MMEMory:STORe or :MMEMory:MSIS:COPY, that requires the memory location to be available.

The USB query returns a 1 when a USB device is plugged into the USB port. It returns 0 if no USB drive is present.

Internal memory in the LMR Master S412E should always be available and the INT query should always return a 1.

Parameter: INTernal|USB

Parameter Type: <char>

Related Command: `:MMEMory:MSIS`
`:MMEMory:MSIS:DESTination`
`:MMEMory:MSIS:COPY`

:SYSTem:OPTions?

Title: Query Installed Options

Description: Returns a string of the installed options. Options are separated by a "/". The string returns `"NONE"` if no options are installed.

Cmd Parameter: **NA** (query only)

Query Response: **NA** (options are separated by `"/"` or `"NONE"`)

Related Command: `*IDN?`

:SYSTem:PRESet

Title: Preset

Description: This command restores all application parameters to their factory preset values. This command does not modify system parameters such as Ethernet configuration, language, volume, or brightness.
Note: After issuing this command, wait 30 seconds for the instrument to complete the preset condition before sending another command.

Syntax: `:SYSTem:PRESet`

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Related Command: `*RST`

Front Panel Access: **Shift-1 (Preset)**, Preset

3-7 [:SENSe]:GPS Subsystem

This subsystem contains commands that relate to the optional GPS (Global Positioning System) on the instrument.

[:SENSe]:GPS ON|OFF|1|0
[:SENSe]:GPS?

Title: GPS State

Required Option: 31

Description: Toggles GPS ON or OFF.

The query form of this command returns a 0 or 1 when GPS state is OFF or ON, respectively.

Front Panel Access: Shift-8 (System), GPS, GPS On/Off

[:SENSe]:GPS:CURRent?

Title: GPS Antenna Current

Required Option: 31

Description: Query only. Reads the current draw, in mA, of the GPS antenna.

Front Panel Access: Shift-8 (System), GPS, GPS Info

[:SENSe]:GPS:RESet

Title: GPS Receiver Reset

Required Option: 31

Description: Resets the optional GPS receiver.

Front Panel Access: Shift-8 (System), GPS, Reset

[:SENSe]:GPS:VOLTage 0|1
[:SENSe]:GPS:VOLTage?

Title: GPS Antenna Voltage

Required Option: 31

Description: Sets the GPS antenna voltage. Send the parameter value 0 to set the voltage to 3.3 V. To set the voltage to 5 V, send a `1 as the` parameter value.

The query form of this command returns a 0 for an antenna voltage of 3.3 V and returns `1` for an antenna voltage of 5 V.

Front Panel Access: Shift-8 (System), GPS, GPS Voltage

Chapter 4 — Spectrum Analyzer Commands

4-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

`:ABORt`

Title: Abort

Description: Restarts the current sweep and/or measurement. Resets the trigger system. 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.

Parameter: NA

Related Command: `:INITiate:CONTinuous`
`:INITiate[:IMMediate]`

4-2 :CALCulate Subsystem

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

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

Title: Limit Alarm

Description: Enables/disables the currently active limit line alarm. Setting the value to ON or 1 will turn on the limit alarm. Setting the value to OFF or 0 will turn off the limit alarm. The query version of the command returns a 1 if the currently selected limit line alarm is set to ON and returns 0 if OFF. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To turn off limit alarm:

```
:CALCulate:LIMit:ALARm OFF
:CALCulate:LIMit:ALARm 0
```

To turn on limit alarm:

```
:CALCulate:LIMit:ALARm ON
:CALCulate:LIMit:ALARm 1
```

Related Command: `:CALCulate:LIMit:TYPe`

Front Panel Access: **Shift-6 (Limit)**, Limit Alarm

:CALCulate:LIMit:CENTer

Title: Move Limit to Current Center Frequency

Description: Moves the center of the current active limit line to the center frequency.

Example: To move the limit to the current center:

```
:CALCulate:LIMit:CENTer
```

Front Panel Access: **Shift-6 (Limit)**, Limit Move, Move Limit to Current Center Freq

:CALCulate:LIMit:ENVelope:CREate

Title: Create Limit Envelope

Description: Creates a limit envelope. This generates a limit line that formed a mask just above or below the existing signals. Note that this command will turn on the currently selected limit line if it is not already on. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Example: To create a limit envelope:

```
:CALCulate:LIMit:ENVelope:CREate
```

Front Panel Access: **Shift-6 (Limit)**, Limit Envelope, Create Envelope

:CALCulate:LIMit:ENVelope:OFFSet <amplitude>
:CALCulate:LIMit:ENVelope:OFFSet?

Title: Limit Envelope Offset

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

Parameter: `<amplitude>`

Default Value: 3 dB for upper limit, –3 dB for lower limit

Default Unit: dB

Range: –100 dB to 100 dB

Example: To set the limit envelope offset to 5dB:

```
:CALCulate:LIMit:ENVelope:OFFSet 5
```

Front Panel Access: **Shift-6 (Limit)**, Limit Envelope, Upper Offset (If Limit is toggled to Upper)
Shift-6 (Limit), Limit Envelope, Lower Offset (If Limit is toggled to Lower)

:CALCulate:LIMit:ENVelope:POINt <number>
:CALCulate:LIMit:ENVelope:POINt?

Title: Number of Limit Envelope Points

Description: Sets the number of inflection point for the currently active limit envelope. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Parameter: `<number>`

Default Value: 21

Range: 2 to 41

Example: To set the number of inflection point to 31:

```
:CALCulate:LIMit:ENVelope:POINt 31
```

Front Panel Access: **Shift-6 (Limit)**, Limit Envelope, Upper Points (If Limit is toggled to Upper)
Shift-6 (Limit), Limit Envelope, Lower Points (If Limit is toggled to Lower)

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

Title: Limit Envelope Shape

Description: Sets the currently active limit envelope shape.

Parameter: `SQUare|SLOPe`

Parameter Type: <char>

Example: To set the limit envelope to a square:

```
:CALCulate:LIMit:ENVelope:SHAPe SQUare
```

Front Panel Access: **Shift-6 (Limit)**, Limit Envelope, Upper Shape (If Limit is toggled to Upper)
Shift-6 (Limit), Limit Envelope, Lower Shape (If Limit is toggled to Lower)

:CALCulate:LIMit:ENVelope:UPDate:Y

Title: Update Limit Envelope Amplitude

Description: Updates the amplitude of the current limit without changing the frequencies of the inflection point. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Example: To adjust the limit envelope amplitude:

```
:CALCulate:LIMit:ENVelope:UPDate:Y
```

Front Panel Access: **Shift-6 (Limit)**, Limit Envelope, Update Envelope Amplitude

:CALCulate:LIMit:FAIL?

Title: Limit Fail State

Description: Query whether the currently active limit line (upper or lower) has failed or not. The command returns a 0 on success, 1 on fail, and 2 if the current active limit is OFF or the alarm is OFF. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

:CALCulate:LIMit:LOWer:ALARm OFF|ON|0|1
:CALCulate:LIMit:LOWer:ALARm?

Title: Lower Limit Alarm

Description: Enables/disables the lower limit alarm. It is a combination of the commands :CALCulate:LIMit:TYPe 1 and :CALCulate:LIMit:ALARm ON|OFF. Setting the value to ON or 1 will turn on the lower limit alarm. Setting the value to OFF or 0 will turn off the lower limit alarm. The query version of the command returns a 1 if the lower limit line alarm is ON and returns 0 if OFF. Note that using this command set the lower limit line active for editing.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Related Command: `:CALCulate:LIMit:ALARm`

Front Panel Access: **Shift-6 (Limit)**, Limit Alarm

:CALCulate:LIMit:LOWer:FAIL?

Title: Lower Limit Fail State

Description: Query whether the lower limit line has failed or not. The command returns a 0 on success, 1 on fail, and 2 if the lower limit line is OFF or the alarm is OFF.

:CALCulate:LIMit:LOWer:POINt?

Title: Number of Lower Limit Points

Description: Returns the number of points currently in the lower limit line.

Default Value: 2

Related Command: `:CALCulate:LIMit:POINt?`

:CALCulate:LIMit:LOWer[:STATe] OFF|ON|0|1
:CALCulate:LIMit:LOWer[:STATe]?

Title: Lower Limit State

Description: Turns the lower limit line ON or OFF. It is a combination of the commands :CALCulate:LIMit:TYPe 1 and :CALCulate:LIMit:STATe ON|OFF. The query version of the command returns a 1 if the lower limit line is ON and returns a 0 if OFF.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on lower limit:

```
:CALCulate:LIMit:LOWer ON
:CALCulate:LIMit:LOWer 1
:CALCulate:LIMit:LOWer:STATe ON
```

To turn off lower limit:

```
:CALCulate:LIMit:LOWer OFF
:CALCulate:LIMit:LOWer 0
:CALCulate:LIMit:LOWer:STATe 0
```

Related Command: `:CALCulate:LIMit:ALARm`

Front Panel Access: **Shift-6 (Limit)**, Limit Lower, Limit On/Off

:CALCulate:LIMit:LTYPe ABSolute|RELative
:CALCulate:LIMit:LTYPe?

Title: Limit Line Type

Description: Sets the currently active limit line type. Absolute limit lines set the limit inflection points based upon the entered frequencies for each point. Relative limit lines set the limit inflection points relative to the current center frequency.

Parameter: `ABSolute|RELative`

Parameter Type: <char>

Default Value: ABSolute

Range: ABSolute|RELative

Example: To set the limit line type to relative:

```
:CALCulate:LIMit:LTYPe RELative
```

Related Command: `:CALCulate:LIMit[:STATe]`

Front Panel Access: **Shift-6 (Limit)**, Limit Advanced, Limit Line Type

:CALCulate:LIMit:MIRRor

Title: Limit Mirror

Description: Creates a limit mirror. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Related Command: `:CALCulate:LIMit:TYPe`

:CALCulate:LIMit:POINt:ADD

Title: Add Limit Point

Description: Adds a new limit point to the currently active limit line. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Related Command: `:CALCulate:LIMit:TYPe`

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Add Point

:CALCulate:LIMit:POINt:DELete

Title: Delete Limit Point

Description: Deletes the currently active limit point. The active point becomes the point that is immediately to the left of the point that was deleted. Note that deletion is only valid if there are more than 2 limit points. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Example: To delete the currently active limit point:

`:CALCulate:LIMit:POINt:DELete`

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Delete Point

:CALCulate:LIMit:POINt:LEFT

Title: Next Point Left

Description: Selects the limit point immediately to the left of the active point, making it active for editing or deleting. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Example: To select the point to the left of the active point:

`:CALCulate:LIMit:POINt:LEFT`

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Next Point Left

:CALCulate:LIMit:POINt:RIGHt

Title: Next Point Right

Description: Selects the limit point immediately to the right of the active point, making it active for editing or deleting. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Example: To select the point to the right of the active point:

`:CALCulate:LIMit:POINt:RIGHt`

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Next Point Right

:CALCulate:LIMit:POINt:X <x-parameter>
:CALCulate:LIMit:POINt:X?

Title: Limit Point X Value

Description: Sets the location of the active limit point on the x-axis at the specified location. <x-parameter> is defined in the current x-axis. Note that this will change the Move Limit on the front panel to Point if it is currently set to Limit. The query version of the command returns the location of the active limit point on the x-axis. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Parameter: `<x-parameter>`

Default Unit: Hz or for zero span in seconds

Example: To set the active point to 5 Hertz:

```
:CALCulate:LIMit:POINt:X 5
:CALCulate:LIMit:POINt:X 5Hz
```

To set the active point to 500 MHz:

```
:CALCulate:LIMit:POINt:X 500MHz
```

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Frequency

:CALCulate:LIMit:POINt:Y <y-parameter>
:CALCulate:LIMit:POINt:Y?

Title: Limit Point Y Value

Description: Sets the location of the active limit point on the y-axis at the specified location. <y-parameter> is defined in the current y-axis. Note that this will change the Move Limit on the front panel to Point if it is currently set to Limit. The query version of the command returns the location of the active limit point on the y-axis. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Parameter: `<y-parameter>`

Default Unit: Current y-axis unit.

Example: To set the active point to 5 dBm:

```
:CALCulate:LIMit:POINt:Y 5
```

(If y-axis unit is dBm)

```
:CALCulate:LIMit:POINt:Y 5dBm
```

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Amplitude

:CALCulate:LIMit:POINt?

Title: Number of Limit Points

Description: Returns the number of points currently in the selected limit line. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Related Command: `:CALCulate:LIMit:TYPe`

:CALCulate:LIMit:TYPe 0|1
:CALCulate:LIMit:TYPe?

Title: Set Limit Line Upper or Lower

Description: Sets the currently active limit line to either upper or lower. Subsequent limit line operations will be performed on the selected limit line.

Parameter: 0|1 (0 = upper limit line, 1 = lower limit line)

Parameter Type: `number`

Default Value: 0 (upper)

Range: 0|1

Example: To set the active limit line to upper:

`:CALCulate:LIMit:TYPe 0`

Related Command: :None

Front Panel Access: **Shift-6 (Limit)**, Limit

:CALCulate:LIMit:UPPer:ALARm OFF|ON|0|1
:CALCulate:LIMit:UPPer:ALARm?

Title: Upper Limit Alarm

Description: Enables/disables the alarm for the upper limit. It is a combination of the commands :CALCulate:LIMit:TYPe 0 and :CALCulate:LIMit:ALARm ON|OFF. Setting the value to ON or 1 will turn on the upper limit alarm. Setting the value to OFF or 0 will turn off the upper limit alarm. The query version of the command returns a 1 if the upper limit line alarm is ON and returns 0 if OFF.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Related Command: `:CALCulate:LIMit:ALARm`

Front Panel Access: **Shift-6 (Limit)**, Limit Alarm

:CALCulate:LIMit:UPPer:FAIL?

Title: Upper Limit Fail State

Description: Query whether the upper limit line has failed or not. The command returns a 0 on success, 1 on fail, and 2 if the upper limit line is OFF or the alarm is OFF.

:CALCulate:LIMit:UPPer:POINt?

Title: Number of Upper Limit Points

Description: Returns the number of points currently in the upper limit line.

Default Value: 2

Related Command: `:CALCulate:LIMit:POINt?`

:CALCulate:LIMit:UPPer[:STATe] OFF|ON|0|1
:CALCulate:LIMit:UPPer[:STATe]?

Title: Upper Limit State

Description: Turns the upper limit line ON or OFF. It is a combination of the commands :CALCulate:LIMit:TYPe 0 and :CALCulate:LIMit:STATe ON|OFF. The query version of the command returns a 1 if the upper limit line is ON and returns a 0 if OFF.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on upper limit:

```
:CALCulate:LIMit:UPPer ON
:CALCulate:LIMit:UPPer 1
:CALCulate:LIMit:UPPer:STATe ON
```

To turn off upper limit:

```
:CALCulate:LIMit:UPPer OFF
:CALCulate:LIMit:UPPer 0
:CALCulate:LIMit:UPPer:STATe 0
```

Related Command: `:CALCulate:LIMit[:STATe]`

Front Panel Access: **Shift-6 (Limit)**, On/Off

:CALCulate:LIMit:VALue <value>

Title: Move Limit

Description: Sets the currently active limit line value. This command moves an entire single or multi-segment limit line up or down by the given <value>. This command is equivalent to the command :CALCulate:LIMit:Y. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Note that this will change the Move Limit on the front panel to Limit if it is currently set to Point.

Parameter: `<value>`

Default Unit: Current y-axis unit.

Related Command: `:CALCulate:LIMit:Y`
`:CALCulate:LIMit:TYPe`

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Amplitude

:CALCulate:LIMit:VERTical:ADD

Title: Add Vertical

Description: Adds vertical. This will add two inflection points that share the same frequency and are centered midpoint between adjacent points. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Related Command: `:CALCulate:LIMit:TYPe`

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Add Vertical

:CALCulate:LIMit:X <x-parameter>

Title: Limit X Value

Description: Sets the location of the active limit line on the x-axis at the specified location. This moves the entire limit and moves the active limit point to the given value. <x-parameter> is defined in the current x-axis. Note that this will change the Move Limit on the front panel to Limit if it is currently set to Point. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Parameter: `<x-parameter>`

Default Unit: Hz or for zero span in seconds

Example: To move the limit and set active point to 5 Hz:

```
:CALCulate:LIMit:X 5
:CALCulate:LIMit:X 5Hz
```

To move the limit and set active point to 500 MHz:

```
:CALCulate:LIMit:X 500MHz
```

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Frequency

:CALCulate:LIMit:Y <y-parameter>

Title: Limit Line Y Value

Description: Sets the location of the active limit line on the y-axis at the specified location. This moves the entire limit and moves the current active limit point by the given value. <y-parameter> is defined in the current y-axis. Note that this will change the Move Limit on the front panel to Limit if it is currently set to Point. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Parameter: `<y-parameter>`

Default Unit: Current y-axis unit.

Example: To move limit and set the active point to 5 dbm:

```
:CALCulate:LIMit:Y 5
```

(If y-axis unit is dBm)

```
:CALCulate:LIMit:Y 5dBm
```

Front Panel Access: **Shift-6 (Limit)**, Limit Edit, Amplitude

:CALCulate:LIMit[:SET]:DEFault

Title: Set Default Limit

Description: Deletes all limit points for the currently active limit line and sets the default limit line value. Note that this command will turn on the currently selected limit line if it is not already on. The current selected limit line can be modified by using the command :CALCulate:LIMit:TYPe.

Example: To set the default limit line:

```
:CALCulate:LIMit[:SET]:DEFault
:CALCulate:LIMit:DEFault
```

Front Panel Access: **Shift-6 (Limit)**, Set Default Limit

:CALCulate:LIMit[:STATe] OFF|ON|0|1
:CALCulate:LIMit[:STATe]?

Title: Limit State

Description: Turns the currently selected limit line (upper or lower) ON or OFF. If the value is set to ON or 1, the currently selected limit line is ON. If the value is set to OFF or 0, the currently selected limit line is OFF. The query version of the command returns a 1 if the currently selected limit line is ON and returns a 0 if OFF. Use :CALCulate:LIMit:TYPe to set the currently active limit line.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on the currently selected limit line:

```
:CALCulate:LIMit ON
:CALCulate:LIMit:STATe ON
:CALCulate:LIMit:STATe 1
```

To turn off the currently selected limit line:

```
:CALCulate:LIMit OFF
:CALCulate:LIMit:STATe 0
:CALCulate:LIMit 0
```

Front Panel Access: **Shift-6 (Limit)**, On/Off

:CALCulate:MARKer:AOFF

Title: Turn All Markers Off

Description: Turns off all markers.

Front Panel Access: **Marker**, More, All Markers Off

:CALCulate:MARKer:PEAK:THReshold <percentage>
:CALCulate:MARKer:PEAK:THReshold?

Title: Peak Threshold

Description: Sets the peak/valley threshold as a percentage of the display. :CALCulate:MARKer:MAXimum:LEFT and :CALCulate:MARKer:MAXimum:RIGHt use this value to determine whether a particular display point qualifies as a peak.

Parameter: `<percentage>`

Default Value: 10

Default Unit: %

Range: 0% to 100%

Front Panel Access: **Marker**, More Peak Options, Peak Threshold

:CALCulate:MARKer:TABLe[:STATe] OFF|ON|0|1
:CALCulate:MARKer:TABLe[:STATe]?

Title: Marker Table State

Description: Turns the Marker Table on or off. Setting the value to ON or 1 will turn on the marker table. Setting the value to OFF or 0 will turn off the marker table.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on marker table:

```
:CALCulate:MARKer:TABLe ON
:CALCulate:MARKer:TABLe 1
```

Front Panel Access: **Marker**, More, Marker Table

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:NOISe[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:NOISe[:STATe]?

Title: Marker Noise

Description: Turns the delta marker noise on or off. Note that if counter marker is set to on when setting marker noise to on, then counter marker is set to off. This command is not valid in zero span. The query version of this command returns a 1 if the specified delta marker is noise marker and returns a 0 if not.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on marker noise for delta marker #1:

```
:CALCulate:MARKer1:DELTa:NOISe ON
:CALCulate:MARKer1:DELTa:NOISe 1
:CALCulate:MARKer:DELTa:NOISe 1
:CALCulate:MARKer:DELTa:NOISe:STATe ON
```

To turn on marker noise for delta marker #2:

```
:CALCulate:MARKer2:DELTa:NOISe ON
:CALCulate:MARKer2:DELTa:NOISe 1
:CALCulate:MARKer2:DELTa:NOISe:STATe ON
```

To turn off marker noise #5:

```
:CALCulate:MARKer5:DELTa:NOISe OFF
:CALCulate:MARKer5:DELTa:NOISe 0
:CALCulate:MARKer5:DELTa:NOISe:STATe OFF
```

Front Panel Access: **Marker**, More, Marker Noise

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:X <x-parameter>
:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:X?

Title: Delta Marker X Value

Description: Sets the location of the delta marker on the x-axis at the specified location <x-parameter> + the reference marker x-axis. <x-parameter> is defined in the current x-axis units. The query version of the command returns the location of the delta marker on the x-axis.

Parameter: `<x-parameter>`

Default Unit: Hz or seconds if in zero span

Example: If both the reference and delta marker #1 is currently at 1 GHz on the x-axis, send the command below to set the delta marker #1 to 2 GHz on the x-axis:

`:CALCulate:MARKer1:DELTa:X 1GHz`

(In zero span) If both the reference and delta marker #1 is currently at 25 us on the x-axis, send the command below to set the delta marker to 50us on the x-axis:

`:CALCulate:MARKer1:DELTa:X 25us`

Related Command: `:CALCulate:MARKer[1]|2|3|4|5|6:X`

Front Panel Access: **Marker**, Delta

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:Y?

Title: Delta Marker Read Y Value

Description: Reads the current Y value for the specified delta marker. The units are the units of the y-axis.

Default Unit: Current y-axis unit

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa[:SET]:SPAN

Title: Delta Marker to Span

Description: Sets the total span width to the value of the specified delta marker. Note that this command is valid only if delta marker is on.

Example: To set the span to the value of delta marker #4:

`:CALCulate:MARKer4:DELTa:SPAN`

Front Panel Access: **Marker**, More Peak Options, Delta Marker to Span

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}:DELTa[:STATe]?

Title: Delta Marker State

Description: Sets the specified delta marker on or off.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on delta marker #3:

```
:CAL1Culate:MARKer3:DELTa ON
:CALCulate:MARKer3:DELTa 1
:CALCulate:MARKer3:DELTa:STATe ON
:CALCulate:MARKer3:DELTa:STATe 1
```

To turn off delta marker #6

```
:CALCulate:MARKer6:DELTa OFF
:CALCulate:MARKer6:DELTa:STATe OFF
:CALCulate:MARKer6:DELTa:STATe 0
```

Front Panel Access: **Marker**, Delta

:CALCulate:MARKer{1|2|3|4|5|6}:FCOunt[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}:FCOunt[:STATe]?

Title: Marker Counter

Description: Turns the marker frequency counter on or off. The marker counter is turned off when the selected marker is turned off. If delta marker is on when setting marker counter to on, then delta marker is turned off. If noise marker is set to on when setting marker counter to on, then noise marker is set to off. This command is not valid in zero span.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on frequency counter for reference marker # 2:

```
:CALCulate:MARKer2:FCOunt ON
:CALCulate:MARKer2:FCOunt 1
```

Front Panel Access: **Marker**, More, Counter Marker

:CALCulate:MARKer{1|2|3|4|5|6}:FIXed[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}:FIXed[:STATe]?

Title: Marker Fixed State

Description: Sets the specified reference marker fixed state on or off. If Fixed is set to on, then the selected reference markers stay at the amplitude they were at when the marker is set to Fixed.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To set reference marker #1 to fixed:

```
:CALCulate:MARKer:FIXed ON
:CALCulate:MARKer:FIXed 1
```

Front Panel Access: **Marker**, More, Marker Style (Fixed)

:CALCulate:MARKer{1|2|3|4|5|6}:MAXimum

Title: Marker (Maximum) Peak Search

Description: Puts the specified marker at the maximum amplitude in the trace.

Front Panel Access: **Marker**, Marker [1/2/3/4/5/6], Peak Search
Marker, Marker [1/2/3/4/5/6], More Peak Options, Peak Search

:CALCulate:MARKer{1|2|3|4|5|6}:MAXimum:LEFT

Title: Marker (Maximum) Peak Search Left

Description: Puts the specified marker on the next highest peak to the left of the current peak. The next highest peak must be above the peak threshold. If no point meets that criterion, the marker is set to the first point on the trace.

Related Command: `:CALCulate:MARKer:PEAK:THReshold`

Front Panel Access: **Marker**, More Peak Options, Next Peak Left

:CALCulate:MARKer{1|2|3|4|5|6}:MAXimum:RIGHt

Title: Marker (Maximum) Peak Search Right

Description: Puts the specified marker on the next highest peak to the right of the current peak. The next highest peak must be above the peak threshold. If no point meets that criterion, the marker is set to the last point on the trace.

Related Command: `:CALCulate:MARKer:PEAK:THReshold`

Front Panel Access: **Marker**, More Peak Options, Next Peak Right

:CALCulate:MARKer{1|2|3|4|5|6}:MAXimum:NEXT

Title: Marker (Maximum) Next

Description: Moves the specified marker to the next highest peak anywhere in the trace that is lower than the current marker. If the specified marker is not on, the command turns the marker on and sets it to the second highest peak in the trace. The command uses the existing peak threshold values to determine the peak value.

Related Command: `:CALCulate:MARKer{1|2|3|4|5|6}:MAXimum:LEFT`
`:CALCulate:MARKer{1|2|3|4|5|6}:MAXimum:RIGHt`

Front Panel Access: N/A

:CALCulate:MARKer{1|2|3|4|5|6}:NOISe[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}:NOISe[:STATe]?

Title: Marker Noise

Description: Turns the marker noise on or off for the specified reference marker. Note that if counter marker is set to on when setting marker noise to on, then counter marker is set to off. This command is not valid in zero span.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To set reference marker #3 as noise marker:

```
:CALCulate:MARKer3:NOISe ON
:CALCulate:MARKer3:NOISe 1
```

Front Panel Access: **Marker**, More, Marker Noise

:CALCulate:MARKer{1|2|3|4|5|6}:X <x-parameter>
:CALCulate:MARKer{1|2|3|4|5|6}:X?

Title: Marker X Value

Description: Sets the location of the marker on the x-axis at the specified location. <x-parameter> is defined in the current x-axis units. The query version of the command returns the location of the marker on the x-axis. Note that the marker is snapped to the data point closest to the specified value. If the specified marker is not on it is set to on.

Note	Setting a marker beyond the current start frequency or stop frequency will result in an invalid power measurement.

Parameter: `<x-parameter>`

Default Unit: Hz or seconds if in zero span

Example: To set reference marker #2 to 5 hertz on the x-axis:

```
:CALCulate:MARKer2:X 5
:CALCulate:MARKer2:X 5Hz
```

To set reference marker #1 to 1.5 GHz on the x-axis:

```
:CALCulate:MARKer:X 1.5GHz
:CALCulate:MARKer1:X 1.5GHz
```

(In zero span) To set reference marker #3 to 1.5 seconds on the x-axis:

```
:CALCulate:MARKer3:X 1.5
:CALCulate:MARKer3:X 1.5s
```

(In zero span) To set reference marker #1 to 25 us:

```
:CALCulate:MARKer:X 25us
:CALCulate:MARker1:X 25us
```

Front Panel Access: **Marker**, Marker [1/2/3/4/5/6]

:CALCulate:MARKer{1|2|3|4|5|6}:Y?

Title: Marker Read Y Value

Description: Reads the current Y value for the specified marker. The units are the units of the y-axis.

Default Unit: Current y-axis unit

:CALCulate:MARKer{1|2|3|4|5|6}[:SET]:CENTer

Title: Marker Frequency to Center

Description: Sets the center frequency equal to the frequency of the specified marker. Note that this will result in a change to the start and stop frequencies and may also result in a change to the span. Note that this command is not valid in zero span.

Front Panel Access: **Marker**, Marker Freq to Center

:CALCulate:MARKer{1|2|3|4|5|6}[:SET]:RLEVel

Title: Marker to Reference Level

Description: Sets the reference level equal to the measured amplitude of the specified marker. Note that this may result in a change to the input attenuation.

Front Panel Access: **Marker**, Marker to Ref Lvl

:CALCulate:MARKer{1|2|3|4|5|6}[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}[:STATe]?

Title: Marker State

Description: Sets the specified marker on/off.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To turn off reference marker #1:

```
:CALCulate:MARKer1:STATe OFF
```

Front Panel Access: **Marker**, On/Off

4-3 :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.

Related Command:
```
:ACPower:STATe
:ACPower:BANDwidth|BWIDth:MAIN
:ACPower:BANDwidth|BWIDth:ADJacent
:ACPower:BANDwidth|BWIDth:SPACing
```

: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.

Related Command:
```
:CHPower:STATe
:SENSe:CHPower:BANDwidth|BWIDth:INTegration
```

:CONFigure:FSTRength

Title: Configure Field Strength

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

Related Command: `:FSTRength:ANTenna`

: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.

Related Command:
```
:OBWidth:STATe
:OBWidth:METHod
:OBWidth:PERCent
:OBWidth:XDB
```

4-4 :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:WINDow:TRACe:Y[:SCALe]:PDIVision <rel ampl>
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Title: Scale

Description: Sets the scale (dB/division) for the y-axis.

Parameter: `<rel ampl>`

Default Value: 10 dB/div

Default Unit: dB

Range: 1 dB to 15 dB

Front Panel Access: **Amplitude**, Scale

:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel <amplitude>
:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?

Title: Reference Level

Description: Sets the reference level amplitude value for the y-axis. Note that this may cause a change in attenuation if the automatic input attenuation coupling is enabled.

Parameter: `<amplitude>`

Default Value: 10 dBm

Default Unit: Current active amplitude unit

Range: With reference level offset = 0 dB: 30 dBm to -150 dBm

Example: To set the reference level to 15 dBm (If y-axis is dBm)

```
:DISPlay:WINDow:TRACe:Y:SCALe:RLEVel 15
:DISPlay:WINDow:TRACe:Y:SCALe:RLEVel 15dBm
```

Related Command: `:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFset`

Front Panel Access: **Amplitude**, Reference Level

:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel ampl>
:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet?

Title: Reference Level Offset

Description: Sets the reference level offset value for the y-axis.

Parameter: `<rel ampl>`

Default Value: 0 dB

Default Unit: dB

Range: -99.9 dB to 99.9 dB

Front Panel Access: **Amplitude**, RL Offset

4-5 :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 3 comma-separated values: main channel power, lower adjacent channel power, upper adjacent channel power.

Default Unit: Current amplitude units

:FETCh:CHPower:CHPower?

Title: Fetch Channel Power

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.

Default Unit: Current amplitude units

Related Command: `:FETCh:CHPower?`
`:FETCh:CHPower:DENSity?`

: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.

Default Unit: Current amplitude units

:FETCh:CHPower?

Title: Fetch Channel Power/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.

Default Unit: Current amplitude units

Related Command: `:FETCh:CHPower:CHPower?`
`:FETCh:CHPower:DENSity?`

:FETCh:OBWidth:FREQuency?

Title: Fetch Occupied Bandwidth Frequency

Description: Returns the most recent occupied bandwidth lower frequency and upper frequency.

Data is returned as 2 comma-separated values: lower frequency and upper frequency in Hz.

Default Unit: Hz

Related Command: `:FETCh:CHPower?`
`:FETCh:CHPower:CHPower?`

:FETCh:OBWidth?

Title: Fetch Occupied Bandwidth

Description: Returns 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 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 3 comma-separated values: occupied bandwidth, percent of power, dB down.

Default Unit: OBW in Hz, Percent of Power in %, dB Down in dB

4-6 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,[<length>]
:FORMat[:READings][:DATA]?

Title: Numeric Data Format

Description: This command specifies the format in which data is returned in certain commands. The optional <length> 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 no length is specified, 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 instrument units. This format requires many more bytes so it is the slowest format. INTeger, 32 values are signed 32-bit integers in little-endian byte order. This format returns the data in 4-byte blocks. The units are always 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 instrument 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 instrument units. For a more precise reading, REAL,64 should be used instead of REAL,32 when the current instrument unit is set to Volt or Watt.

Both INTeger and REAL formats return a definite block length. Each transfer begins with an ASCII header such as #42204 for INTeger,32 and REAL,32 and #44408 for REAL,64. The first digit represents the number of following digits in the header (in this example, 4). The remainder of the header indicates the number of bytes that follow the header (in this example, 2204 for INT,32 and REAL,32 and 4408 for REAL,64). You then divide the number of following bytes by the number of bytes in the data format you've chosen (4 for both INTeger,32 and REAL,32, and 8 for REAL,64) to get the number of data points (in this example, 551).

Parameter: ASCii|INTeger,32|REAL,[<length>]

Parameter Type: <char>

Default Value: ASCii

Related Command: :TRACe[:DATA]

4-7 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Title: Continuous/Single Sweep

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 enters the "idle" state and waits for the :INITiate[:IMMediate] command or for :INITiate:CONTinuous ON. 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. Note that rapid toggling between ON and OFF is not allowed. The instrument must be allowed to make a full sweep before toggling can be done.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON

Related Command: `:INITiate[:IMMediate]`
`:INITiate:HOLD`

Front Panel Access: **Shift-3 (Sweep)**, Sweep

:INITiate[:IMMediate]

Title: Trigger Sweep/Measurement

Description: Initiates a sweep/measurement. If :INITiate:CONTinuous is set to ON, this command is ignored. Use this command in combination with :STATus:OPERation? 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.

When averaging is on, the sweep complete bit is set after the first sweep is completed. An :INITiate[:IMMediate] command must be issued for each additional sweep desired.

Related Command: `:INITiate:CONTinuous`
`:STATus:OPERation?`

Front Panel Access: **Shift-3 (Sweep)**, Sweep Once

4-8 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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 and upper adjacent channel power results. It is a combination of the commands :CONFigure:ACPower and :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 3 comma-separated values: main channel power, lower adjacent channel power, upper adjacent channel power.

Default Unit: Current amplitude units

Related Command: `:CONFigure:ACPower`

: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 the channel power result. To measure both channel power and channel power density use :MEASure:CHPower? It is a combination of the commands :CONFigure:CHPower and :READ:CHPower: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:CHPower?

Default Unit: Current amplitude units

Related Command: `:MEASure:CHPower?`
`:MEASure:CHPower:DENSity?`
`:CONFigure: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 the channel power density result. To measure both channel power and channel power density use :MEASure:CHPower? It is a combination of the commands :CONFigure:CHPower and :READ:CHPower:DENSity? 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:DENSity?

Default Unit: Current amplitude units

Related Command: `:MEASure:CHPower?`
`:MEASure:CHPower:CHPower?`
`:CONFigure:CHPower`

:MEASure:CHPower?

Title: Measure Channel Power/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 and :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.

Default Unit: Current amplitude units

Related Command: `:MEASure:CHPower:CHPower?`
`:MEASure:CHPower:DENSity?`
`:CONFigure:CHPower`

:MEASure:OBWidth?

Title: Measure Occupied Bandwidth

Description: Sets the active measurement to occupied bandwidth, sets the default measurement parameters, triggers a new measurement and returns the occupied bandwidth, percent of power and dB down results. It is a combination of the commands :CONFigure:OBWidth and :READ:OBWidth? For a description of the default occupied bandwidth measurement parameters, see :CONFigure:OBWidth. To make an occupied bandwidth measurement with settings other than the default values, send:

:CONFigure:OBWidth
Commands to set desired settings
:READ:OBWidth?

Data is returned as 3 comma-separated values: occupied bandwidth, percent of power, dB down.

Default Unit: OBW in Hz, Percent of Power in %, dB Down in dB

Related Command: `:CONFigure:OBWidth`
`:CONFigure:RF SPECtrum`

4-9 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:LIMit <file name>

Title: Recall Limit

Description: Recalls a previously stored limit from the current save location. The saved limit setting to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".lim". Note that the trace specified by <file name> should be available at the current save location. Use the command MMEMory:MSIS to set the current save location. File Extension: ".lim"

Parameter: `<file name>`

Example: To recall trace with file name "limit"

`:MMEMory:LOAD:LIMit "limit.lim"`

Related Command: `:MMEMory:STORe:LIMit`

Front Panel Access: **Shift-7 (File)**, Recall

:MMEMory:LOAD:STATe <integer>,<file name>

Title: Recall Setup

Description: Recalls a previously stored instrument setup in the current save location. The setup file to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

Parameter: `<integer>, <file name>`

Related Command: `:MMEMory:STORe:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Recall

:MMEMory:LOAD:TRACe <integer>,<file name>

Note	This command requires front panel access to select the trace and to complete the command.

Title: Recall Measurement

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use :INSTrument:SELect or :INSTrument:NSELect to set the mode. Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should contain a file extension. Note that the trace specified by <file name> should be available at the current save location. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

File name extensions:

“`.spa`” for SPA measurement
“`.mna`” for VNA and VVM measurements
“`.hipm`” for HiPM measurements
“`.pm`” for PM measurements
“`.cwsg`” for CWSG measurements
“`.afp`” for AM/FM/PM measurements
“`.ia`” for Interference Analysis measurements
“`.cs`” for Channel Scanner measurements
“`.wmxd`” for WiMAX
“`.wmxe`” for Mobile WiMAX
“`.lte`” for LTE measurements
“`.p25`” for P25 measurements
“`.p252`” for P25p2 measurements
“`.nxdn`” for NXDN measurements
“`.dpmr`” for dPMR measurements
“`.dmr2`” for DMR 2 measurements
“`.ptc`” for PTC measurements
“`.tetra`” for TETRA measurements
“`.nbfm`” for NBFM measurements

Parameter: `<integer>,<file name>`

Example: To recall trace with file name “trace”:

`:MMEMory:LOAD:TRACe 1,”trace.spa”`

Related Command: `:MMEMory:STORe:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Recall Measurement

:MMEMory:STORe:LIMit <file name>

Title: Save Limit

Description: Stores the current limit setup into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location.

Parameter: `<file name>`

Related Command: :MMEMory:MSIS INTernal|USB

Front Panel Access: **Shift-7 (File)**, Save

:MMEMory:STORe:STATe <integer>,<file name>

Title: Save Setup

Description: Stores the current setup into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a value of 0.

Parameter: `<integer>, <file name>`

Related Command: `:MMEMory:LOAD:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**

:MMEMory:STORe:TRACe <integer>,<file name>

Title: Save Measurement

Description: Stores the trace into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 0.

Parameter: `<integer>, <file name>`

Example: To save the trace into the file name “trace”:

`:MMEMory:STORe:TRACe 0,”trace”`

Related Command: `:MMEMory:LOAD:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Save

4-10 :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 3 comma-separated values: main channel power, lower adjacent channel power, upper adjacent channel power.

Default Unit: Current amplitude units

Related Command: `:READ:ACPower?`
`:CON`

:READ:CHPower:DENSity?

Title: Read Channel Power Density

Description: Triggers a new channel power measurement and returns the channel power density result. It is a combination of the commands :ABORT; :INITiate; :FETCh:CHPower:DENSity? It returns only the channel power density, not the channel power. Use the command :READ:CHPower? to get both channel power and channel power density. The channel power measurement must be the active measurement (specified by :CONFigure:CHPower). The current measurement can be queried using :CONFigure? command.

Default Unit: Current amplitude units

Related Command: `:READ:CHPower?`
`:READ:CHPower:CHPower?`
`:CONFigure`

:READ:CHPower?

Title: Read Channel Power/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). The current measurement can be queried using the command :CONFigure?

Data is returned as 2 comma-separated values: channel power, channel power density.

Default Unit: Current amplitude units

Related Command: `:READ:CHPower:CHPower?`
`:READ:CHPower:DENSity?`
`:CONFigure`

:READ:CHPower?

Title: Read Channel Power

Description: Triggers a new channel power measurement and returns the results. It is a combination of the commands :ABORT; :INITiate; :FETCh:CHPower? The channel power measurement must be active. The current measurement can be queried using :CONFigure?

Default Unit: dBm

Related Command: `:CONFigure:RF ACLR`

:READ:OBWidth?

Title: Read Occupied Bandwidth

Description: Triggers a new occupied bandwidth measurement and returns the results: occupied bandwidth, percent of power and dB down. It is a combination of the commands :ABORT; :INITiate; :FETCh:OBWidth? The occupied bandwidth measurement must be the active measurement (specified by :CONFigure:OBWidth). The current measurement can be queried using the :CONFigure?

Data is returned as 3 comma-separated values: occupied bandwidth, percent of power, and dB down.

Default Unit: OBW in Hz, Percent of Power in %, dB Down in dB

Related Command: `:CONFigure`

4-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:COPY TRACE1,TRACE2|TRACE3

Title: Trace Copy

Description: Copies Trace A to either Trace B or Trace C. Copying Trace A to Trace B is equivalent to pressing the Shift-5 (Trace), Trace B Operations, A->B on the front panel. This store Trace A into Trace B and turns on Trace B if it was off. Copying Trace A to Trace C is equivalent to pressing the Shift-5 (Trace), Trace C Operations, A->C on the front panel. This store Trace A into Trace C and turns on Trace C if it was off.

Parameter: `TRACE1,TRACE2|TRACE3`

Parameter Type: <char>

Example: To copy Trace A to Trace B:

`:TRACe:COPY TRACE1,TRACE2`

To copy Trace A to Trace C:

`:TRACe:COPY TRACE1,Trace3`

:TRACe:EXCHange TRACE2,TRACE3

Title: Trace Exchange

Description: Swaps Trace B and Trace C.

Parameter: `TRACE2,TRACE3`

Parameter Type: <char>

Front Panel Access: **Shift-5 (Trace)**, Trace B Operations, B<->C
Shift-5 (Trace), Trace C Operations, B<->C

`:TRACe:PREamble? {1|2|3}`

Title: Trace Header Transfer

Description: Returns trace header information for the specified trace. Data can be transferred to and from the 3 available display traces. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It looks like #AX, where A is the number of digits in X and X is the number of bytes that follow the header. Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "NAME=VALUE[UNITS]," Note that the parameters returns depend on the firmware version and that this document does not cover all parameter values returned by the command. Refer to Table 4-1 for valid parameter names.

Parameter: `[1]|2|3`

Range: 1|2|3

Trace Header Parameters

Table 4-1 describes parameters that can be returned by the `:TRACe:PREamble?` command.

Table 4-1. Available Parameters in Spectrum Analyzer Mode (Sheet 1 of 5)

Parameter Name	Description
SN	Instrument serial #
UNIT_NAME	Instrument name
DESCR	Trace name
DATE	Trace date/time
BASE_VER	Base FW version
APP_NAME	Application name
APP_VER	Application FW version
UNITS	Amplitude units
CENTER_FREQ	Center frequency
SPAN	Frequency span
FREQ_STEP	Frequency step size
FREQUENCY_OFFSET	Frequency Offset
OFFSET_STEP_SIZE	Offset Step Size
OFFSET_CENTER_FREQ	Center Frequency with Frequency Offset
OFFSET_START_FREQ	Start Frequency with Frequency Offset
OFFSET_STOP_FREQ	Stop Frequency with Frequency Offset
RBW	Resolution bandwidth
RBW_TYPE	RBW coupling auto/manual

Table 4-1. Available Parameters in Spectrum Analyzer Mode (Sheet 2 of 5)

Parameter Name	Description
VBW	Video bandwidth
VBW_TYPE	VBW coupling auto/manual
RBW_VBW_RATIO	RBW/VBW ratio
SPAN_RBW_RATIO	Span/RBW ratio
INPUT_ATTEN	Input attenuation
ATTEN_TYPE	Attenuation coupling auto/manual
REFERENCE_LEVEL	Reference level
SCALE	Y-axis scale
PREAMP_SET	Preamp state
REF_LEVEL_OFFSET	Reference level offset
DETECTION	Detection type
TRACE_AVERAGE	Number of traces to average
SWEEP_TYPE	Single/continuous
CURRENT_SIGNAL	Current signal index
CURRENT_CHANNEL	Current signal channel
TRACE_MODE	Normal/Avg/Max
TRACE_STATUS	TRACE_A_VIEW_NOT_BLANK: 0x0000000000000001 TRACE_A_WRITE_NOT_HOLD: 0x0000000000000002 TRACE_A_DATA_VALID: 0x0000000000000004 TRACE_B_VIEW_NOT_BLANK: 0x0000000000010000 TRACE_B_WRITE_NOT_HOLD: 0x0000000000020000 TRACE_B_DATA_VALID: 0x0000000000040000 TRACE_C_VIEW_NOT_BLANK: 0x0000000100000000 TRACE_C_WRITE_NOT_HOLD: 0x0000000200000000 TRACE_C_DATA_VALID: 0x0000000400000000 TRACE_C_IS_B_MINUS_A_ON: 0x0000001000000000 TRACE_C_IS_A_MINUS_B_ON: 0x0000002000000000
TRACE_COUNT	Number of traces averaged
UI_DATA_POINTS	Number of display points

Table 4-1. Available Parameters in Spectrum Analyzer Mode (Sheet 3 of 5)

Parameter Name	Description
IMPEDANCE	Input impedance
REFERENCE_FREQUENCY	Reference freq
SET_SWEEP_TIME	Minimum sweep time setting
TRIGGER_TYPE	Trigger type
VIDEO_TRIGGER_LEVEL	Video trigger level
TRIGGER_POSITION	Trigger position as a percent of the display
PEAK_THRESHOLD	Marker peak search threshold
MARKER_TABLE	Marker table status
ACTIVE_ MEASUREMENT	Current measurement
ANTENNA	Antenna index
OCC_BW_METHOD	Occupied bandwidth method
OCC_BW_PERCENT	Occupied bandwidth % of power setting
OCC_BW_DBC	Occupied bandwidth dBc setting
OCC_BW_MEASURED_ DB	Occupied bandwidth measured dBc value
OCC_BW_MEASURED_ PERCENT	Occupied bandwidth measured % value
OCC_BW_VALUE	Measured occupied bandwidth
OCC_BW_LINE_ MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 3 OBW display indicators
CH_PWR_WIDTH	Channel power integration bandwidth
CH_PWR_VALUE	Measured channel power
CH_PWR_DENSITY	Measured channel power density
CH_PWR_LINE_ MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 channel power display indicators
ACPR_MAIN_CH_BW	ACPR main channel bandwidth
ACPR_ADJC_CH_BW	ACPR adjacent channel bandwidth
ACPR_CHANNEL_ SPACING	ACPR channel spacing
ACPR_MAIN_CH_PWR	ACPR measured main channel power
ACPR_UPPER_CH_PWR	ACPR measured upper channel power
ACPR_LOWER_CH_ PWR	ACPR measured lower channel power
ACPR_LOWER_CH_ LINE_MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 ACPR lower channel display indicators
ACPR_MAIN_CH_LINE_ MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 ACPR main channel display indicators

Table 4-1. Available Parameters in Spectrum Analyzer Mode (Sheet 4 of 5)

Parameter Name	Description
ACPR_UPPER_CH_ LINE_MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 ACPR upper channel display indicators
AM_FM_DEMOD_VOL	AM/FM demod volume
AM_FM_DEMOD_ FREQUENCY	AM/FM demod freq
AM_FM_DEMOD_TYPE	AM/FM demod type
AM_FM_DEMOD_TIME	AM/FM demod time
AM_FM_LINE_ MARKER	Display point location of the demodulation frequency
BEAT_FREQUENCY_ OSC_FREQUENCY	BFO oscillator freq
CI_C_TYPE	C/I measurement carrier type
CI_C_VALUE	C/I measurement measured carrier power
CI_I_BB_VALUE	C/I measurement measured broadband interference power
CI_I_NB_VALUE	C/I measurement measured narrowband interference power
CI_I_WB_VALUE	C/I measurement measured wideband interference power
CI_BB_VALUE	C/I measurement with broadband interference
CI_NB_VALUE	C/I measurement with narrowband interference
CI_WB_VALUE	C/I measurement with wideband interference
MKR_SPA_FREQNx	Marker x frequency (where x is the marker number 0-11, 0 represent the reference marker #1 and 1 represent delta marker #1, 2 represent reference marker #2, and 3 represent delta marker #2, and so on)
MKR_SPA_POINTx	Reference marker x display point
MKR_SPA_MAGNTx	Reference marker x magnitude
MKR_SPA_PRCNTx	Reference marker x display percentage

Table 4-1. Available Parameters in Spectrum Analyzer Mode (Sheet 5 of 5)

Parameter Name	Description
MKR_SPA_FLAGSx	Reference marker x flags: SPA_MKR_FLAG_ON_OFF: 0x00000001 SPA_MKR_FLAG_DELTA_MKR: 0x00000002 SPA_MKR_FLAG_SELECTED: 0x00000004 SPA_MKR_FLAG_DATA_INVALID: 0x00000008 SPA_MKR_FLAG_DATA_STALE: 0x00000010 SPA_MKR_FLAG_FIXED: 0x00000020 SPA_MKR_FLAG_MASK: 0x000000FF SPA_MKR_FLAG_DISPL_AMPL_HZ: 0x00000100 SPA_MKR_FLAG_DISPL_AMPL_PER_HZ: 0x00000200 SPA_MKR_FLAG_DISP_FLAG: 0x00000F00 SPA_MKR_FLAG_RELATIVE: 0x00001000 SPA_MKR_STANDARD: 0x10000000 SPA_MKR_FIELD_STRENGHT: 0x20000000 SPA_MKR_NOISE: 0x30000000 SPA_MKR_COUNTER: 0x40000000 SPA_MKR_TIME: 0x50000000
MKR_SPA_REF_TOx	Specifies which marker is the marker x reference to
MKR_SPA_TRACex	Specifies which trace the marker x is for.
LIM_LFLAGS_UP	Upper limit flags: LIMIT_FLAG_ON: 0x00000004 LIMIT_FLAG_ALARM_ON: 0x00000002
LIM_FREQNC_UPx	Upper limit point x freq (where x is the limit point number starting with 0)
LIM_MAGNTD_UPx	Upper limit point x amplitude
LIM_LFLAGS_LO	Lower limit flags: LIMIT_FLAG_ON: 0x00000004 LIMIT_FLAG_ALARM_ON: 0x00000002
LIM_FREQNC_LOx	Lower limit point x freq (where x is the limit point number starting with 0)
LIM_MAGNTD_LOx	Lower limit point x amplitude

`:TRACe[:DATA] {1|2|3},(<header><block>)`
`:TRACe[:DATA]? {1|2|3}`

Title: Trace Data Transfer

Description: This command transfers data from the controlling program to the instrument. The query form transfers trace data from the instrument to the controller. Data is transferred to the instrument enclosed in parentheses as (<header><block>) and from the instrument as <header><block>.

The ASCII 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 format of the block data in the query form is specified by :FORMat:DATA. The block data in the command form is always sent in ASCII format. Data can be transferred to and from the 3 available display traces. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. The command form does not support setting all trace points to a single value. To do this, send the same value to each point. Trace setup information can be acquired using :TRACe[:DATA]:PREamble?

To acquire the data from trace A in the instrument, send :TRACe[:DATA]? 1. A 551 point trace is returned as #42204<block data>. <block> data could be in either INTeger,32 or REAL,32 format. In both cases, there is 4 bytes per data point. So, 4 bytes per point * 551 data points gives 2204 bytes in <block> data. This example assumes that :FORMat:DATA INTeger,32 or :FORMat:DATA REAL,32 has been sent to the instrument before the query command is sent.

The query command will return a #0 if data is invalid for the active trace.

Parameter: `{1|2|3},(<header><block>)`

Related Command: `:FORMat:DATA`
`:TRACe[:DATA]:PREamble?`

:TRACe{1|2|3}:DISPlay[:STATe] OFF|ON|0|1
:TRACe{1|2|3}:DISPlay[:STATe]?

Title: Trace View State

Description: Specifies whether the specified trace should be displayable (visible) or hidden. TRACe1 corresponds to Trace A, TRACe2 corresponds to Trace B, and TRACe3 corresponds to Trace C. Setting the value to ON or 1 will set the specified trace visible. Setting the value to OFF or 0 will set the specified trace hidden. Note that issuing this command will also set the specified trace as active trace.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON for Trace A
OFF for Trace B
OFF for Trace C

Example: To set Trace A to Blank:

```
:TRACe:DISPlay OFF
:TRACe1:DISPlay 0
```

To set Trace B to View:

```
:TRACe2:DISPlay ON
:TRACe2:DISPlay:STATe ON
:TRACe2:DISPlay 1
```

Front Panel Access: **Shift-5 (Trace)**, View/Blank

:TRACe{1|2|3}:LOAD:DISPlay[:STATe] OFF|ON|0|1
:TRACe{1|2|3}:LOAD:DISPlay[:STATe]?

Title: Trace View State

Description: Specifies whether the specified recall trace should be displayable (visible) or hidden. TRACe1 corresponds to Trace A, TRACe2 corresponds to Trace B, and TRACe3 corresponds to Trace C. Setting the value to ON or 1 will set the specified trace visible. Setting the value to OFF or 0 will set the specified trace hidden. Note that this command is valid only if there is a trace recalled.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Example: To set Trace A to Blank:

```
:TRACe:LOAD:DISPlay OFF
 :TRACe1:LOAD:DISPlay 0
```

To set Trace B to View:

```
:TRACe2:LOAD:DISPlay ON
:TRACe2:LOAD:DISPlay:STATe ON
:TRACe2:LOAd:DISPlay 1
```

Front Panel Access: **Shift-5 (Trace)**, Trace [A/B/C], View Blank

Note	These SCPI commands are applicable only if the user selects the option to recall the trace to Trace A and not show the live trace.

`:TRACe{1|2|3}:WRITe[:STATe] OFF|ON|0|1`
`:TRACe{1|2|3}:WRITe[:STATe]?`

Title: Trace Write State

Description: Specifies whether the specified trace state should be set to write or hold. TRACe1 corresponds to Trace A, TRACe2 corresponds to Trace B, and TRACe3 corresponds to Trace C. Setting the state to ON or 1 will set the specified trace to write. Setting the state to OFF or 0 will set the specified trace to hold.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON for Trace A
OFF for Trace B
OFF for Trace C

Example: To set Trace A to Hold:

```
:TRACe:WRITe:STATe OFF
:TRACe:WRITe OFF OR :TRACe:WRITe 0
```

To set Trace C to Write:

```
:TRACe3:WRITe ON
:TRACe3:WRITe:STATe ON
:TRACe3:WRITe 1
```

Related Command: `:TRACe:DATA`

Front Panel Access: **Shift-5 (Trace)**, Write/Hold

:TRACe1:OPERation NORMal|MAXHold|MINHold|AVERage
:TRACe1:OPERation?

Title: Trace A Operation

Description: This command specifies how successive traces are combined to produce the resulting display values.

Setting the operation to NORMal is equivalent to pressing the Shift-5 (Trace), Trace A Operations, Normal->A on the front panel. This displays a trace based on the detection method selected.

Setting the operation to MAXHold is equivalent to pressing the Shift-5 (Trace), Trace A Operations, Max Hold->A on the front panel. This displays the largest signal for each display point over multiple sweeps.

Setting the operation to MINHold is equivalent to pressing the Shift-5 (Trace), Trace A Operations, Min Hold->A on the front panel. This displays the smallest signal for each display point over multiple sweeps.

Setting the operation to AVERage is equivalent to pressing the Shift-5 (Trace), Trace A Operations, Average->A on the front panel. This displays the average value of multiple sweeps for each display point.

The query version of the command returns the current operation mode or “NONE” if no operation is set.

Parameter: `NORMal|MAXHold|MINHold|AVERage`

Parameter Type: <char>

Default Value: NORMal

Related Command: `:AVERage:TYPE`

:TRACe2:OPERation MAXHold|MINHold
:TRACe2:OPERation?

Title: Trace B Operation

Description: This command specifies how successive traces are combined to produce the resulting display values.

Setting the operation to MAXHold is equivalent to pressing the Shift-5 (Trace), Trace B Operations, Max Hold->B on the front panel. This displays the largest signal for each display point over multiple sweeps.

Setting the operation to MINHold is equivalent to pressing the Shift-5 (Trace), Trace B Operations, Min Hold->B on the front panel. This displays the smallest signal for each display point over multiple sweeps.

The query version of the command returns the current operation mode or “NONE” if no operation is set.

Parameter: `MAXHold|MINHold`

Parameter Type: <char>

Default Value: None

Range: MAXHold|MINHold

:TRACe3:OPERation MAXHold|MINHold|A-B|B-A
:TRACe3:OPERation?

Title: Trace C Operation

Description: This command specifies how successive traces are combined to produce the resulting display values.

Setting the operation to MAXHold is equivalent to pressing the Shift-5 (Trace), Trace C Operations, Max Hold->C on the front panel. This displays the largest signal for each display point over multiple sweeps.

Setting the operation to MINHold is equivalent to pressing the Shift-5 (Trace), Trace C Operations, Min Hold->C on the front panel. This displays the smallest signal for each display point over multiple sweeps.

Setting the operation to A-B is equivalent to pressing the Shift-5 (Trace), Trace C Operations, A-B->C. This displays the difference between trace A and trace B values in trace C.

Setting the operation to B-A is equivalent to pressing the Shift-5 (Trace), Trace C Operations, B-A->C. This displays the difference between trace B and trace A values in trace C.

The query version of the command returns the current operation mode or "NONE" if no operation is set.

Parameter: `MAXHold|MINHold|A-B|B-A`

Parameter Type: <char>

Default Value: None

Range: MAXHold|MINHold|A-B|B-A

4-12 :TRIGger Subsystem

This subsystem contains commands related to the triggering of instrument functions for the purposes of synchronization. Related commands appear in the ABORt and INITiate subsystems.

:TRIGger[:SEQuence]:SOURce IMMediate|EXTernal|VIDeo
:TRIGger[:SEQuence]:SOURce?

Title: Trigger Source

Description: This command defines the trigger source. IMMediate triggering is the equivalent of free-run triggering. EXTernal triggering is triggered when a TTL signal is applied to the External Trigger input connector. EXTernal triggering is always done on the rising edge of the signal. It is available only in zero span mode.

Parameter: `IMMediate|EXTernal|VIDeo`

Parameter Type: <char>

Default Value: Immediate

Range: IMMediate|EXTernal|VIDeo

Related Command: `:TRIGger[:SEQuence]:VIDeo:LEVel`
`:TRIGger[:SEQuence]:VIDeo:DELay`

Front Panel Access: **Shift-3 (Sweep)**, Triggering, Source

:TRIGger[:SEQuence]:VIDeo:LEVel <amplitude>
:TRIGger[:SEQuence]:VIDeo:LEVel?

Title: Video Trigger Level

Description: This command sets the video triggering level.

Parameter: `<amplitude>`

Default Value: -65.0 dBm

Default Unit: Current amplitude unit

Range: 30 dBm to -150 dBm

Related Command: `:TRIGger[:SEQuence]:SOURce`

Front Panel Access: **Shift-3 (Sweep)**, Triggering, Level

:TRIGger[:SEQuence]:VIDeo:DELay <percentage> or <time>
:TRIGger[:SEQuence]:VIDeo:DELay?

Title: Video Trigger Position (Time)

Description: This command sets the video triggering delay as either a percentage of the display or in time units. If setting the delay by time is desired, then time units must be specified when sending the command. The query version of this command returns the video triggering delay as a percentage.

Parameter: `<percentage> or <time>`

Default Value: –1

Default Unit: %

Range: –100% to +200% (–1 ms to +2 ms)

Example: To set the delay to 1 ms:

```
:TRIGger:SEQuence:VIDeo:DELay 1 ms
```

To set the delay to 1%:

```
:TRIGger:SEQuence:VIDeo:DELay 1
```

Front Panel Access: **Shift-3 (Sweep)**, Triggering, Delay

4-13 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer DBM|DBV|DBMV|DBUV|V|W
:UNIT:POWer?

Title:	Measurement Units
Description:	Sets the default amplitude units for input, output and display. Available units: dBm, dBV, dBmV, dBuV, V, W. Note that linear units are not operational with SPA V3.06. The set command is non-operational with SPA V3.06 as well.
Parameter:	`DBM|DBV|DBMV|DBUV|V|W`
Parameter Type:	<char>
Default Value:	dBm
Front Panel Access:	**Amplitude**, Units

4-14 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent <freq>
[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent?

Title: ACPR Adjacent Channel Bandwidth

Description: Sets the adjacent channel bandwidth for the ACPR measurement.

Parameter: <freq>

Default Value: 10.35 MHz

Default Unit: Hz

Front Panel Access: **Shift-4 (Measure)**, ACPR, Adj Ch BW

[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN <freq>
[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN?

Title: ACPR Main Channel Bandwidth

Description: Sets the main channel bandwidth for the ACPR measurement.

Parameter: <freq>

Default Value: 10.35 MHz

Default Unit: Hz

Front Panel Access: **Shift-4 (Measure)**, ACPR, Main Ch BW

[:SENSe]:ACPower:BANDwidth|BWIDth:SPACing <freq>
[:SENSe]:ACPower:BANDwidth|BWIDth:SPACing?

Title: ACPR Channel Spacing

Description: Sets the channel spacing for the ACPR measurement.

Parameter: <freq>

Default Value: 10.35 MHz

Default Unit: Hz

Front Panel Access: **Shift-4 (Measure)**, ACPR, Ch Spacing

`[:SENSe]:ACPower:STATe OFF|ON|0|1`
`[:SENSe]:ACPower:STATe?`

Title: ACPR Measurement 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: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

`[:SENSe]:AVERage:COUNt <integer>`
`[:SENSe]:AVERage:COUNt?`

Title: Number of Traces to Average

Description: Sets the number of traces to average.

Parameter: `<integer>`

Parameter Type: <integer>

Default Value: 10

Range: 2 to 65535

Front Panel Access: **Shift-5 (Trace)**, Trace A Operations, # of Averages

[:SENSe]:AVERage:TYPE NONE|SCALar|MAXimum|MINimum
[:SENSe]:AVERage:TYPE?

Title: Trace Mode (Normal/Average/Max Hold/Min Hold)

Description: Specifies how successive traces are combined to produce the resulting display value. Setting the TYPE to NONE is the equivalent of setting the trace mode to "Normal->A" on the front panel. The displayed value for a point is the current measured value for that point. Setting the TYPE to SCALar is the equivalent of setting the trace mode to "Average->A" on the front panel. The displayed value for a point is the average of the last <integer> measured values where <integer> is set by [:SENSe]:AVERage:COUNt. Setting the TYPE to MAXimum is the equivalent of setting the trace mode to "Max Hold->A" on the front panel. The displayed value for a point is the maximum measured value for that point over sweeps. Setting the TYPE to MINimum is the equivalent of setting the trace mode to "Min Hold->A" on the front panel. The displayed value for a point is the minimum measured value for that point over sweeps.

Parameter: `NONE|SCALar|MAXimum|MINimum`

Parameter Type: <char>

Default Value: NONE

Example: To set the TYPE to SCALar:

`:SENSe:AVERage:TYPE SCALar`

To set the TYPE to MAXimum:

`:SENSe:AVERage:TYPE MAXimum`

Related Command: `:AVERage:COUNt`

Front Panel Access: **Shift-5 (Trace)**, Trace A Operations

[:SENSe]:BANDwidth|BWIDth:VIDeo <freq>
[:SENSe]:BANDwidth|BWIDth:VIDeo?

Title: Video Bandwidth

Description: Sets the video bandwidth. Note that using this command turns the automatic video bandwidth setting OFF.

Parameter: `<freq>`

Default Value: 1 MHz

Default Unit: Hz

Range: 1 Hz to 3 MHz in a 1:3 sequence except for the MS2711E
10 Hz to 3 MHz in a 1:3 sequence for the MS2711E

Related Command: `:BANDwidth|BWIDth:VIDeo:AUTO`

Front Panel Access: **BW**, VBW

[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO OFF|ON|0|1
[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO?

Title: Video Bandwidth Coupling

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 un-coupled from the resolution bandwidth. That is, changing the resolution bandwidth will not change the video bandwidth. When this command is issued, the video bandwidth setting itself will not change. The default value is ON. That is, sending :SENS:BAND:VID:AUTO is equivalent to sending :SENS:BAND:VID:AUTO ON.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON

Front Panel Access: **BW**, Auto VBW

[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio <number>
[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio?

Title: Video Bandwidth to Resolution Bandwidth 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, i.e., if you send 0.35, the display will show 2 not 2.857.

Parameter: `<number>`

Default Value: 0.33

Range: 0.00001 to 1

Related Command: `:BANDwidth|BWIDth:VIDeo:AUTO`

Front Panel Access: **BW**, RBW/VBW (note that this is the inverse ratio)

[:SENSe]:BANDwidth|BWIDth[:RESolution] <freq>
[:SENSe]:BANDwidth|BWIDth[:RESolution]?

Title: Resolution Bandwidth

Description: Sets the resolution bandwidth. Note that using this command turns the automatic resolution bandwidth setting OFF.

Parameter: `<freq>`

Default Value: 3 MHz

Default Unit: Hz

Range: 10 Hz to 3 MHz in a 1:3 sequence except for the MS2711E
100 Hz to 3 MHz in a 1:3 sequence for the MS2711E

Related Command: `:BANDwidth|BWIDth[:RESolution]:AUTO`

Front Panel Access: **BW**, RBW

[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO OFF|ON|0|1
[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO?

Title: Resolution Bandwidth Coupling

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 un-coupled 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. The default value is ON. That is, sending :SENS:BAND:RES:AUTO is equivalent to sending :SENS:BAND:RES:AUTO ON.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON

Related Command: `[:SENSE]:BANDwidth|BWIDth[:RESolution]:RATio`

Front Panel Access: **BW**, Auto RBW

[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio <number>
[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio?

Title: Resolution Bandwidth to 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.

Parameter: `<number>`

Default Value: 0.01

Range: 0.00001 to 1

Related Command: `:BANDwidth|BWIDth[:RESolution]:AUTO`

Front Panel Access: **BW**, Span/RBW (note that this is the inverse ratio)

[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration <freq>
[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration?

Title: Channel Power Integration Bandwidth

Description: Sets the integration bandwidth for the channel power measurement. Integration bandwidth must be less than or equal to the frequency span.

Parameter: `<freq>`

Default Value: 10.35 MHz

Default Unit: Hz

Related Command: `:FREQuency:SPAN`

Front Panel Access: **Shift-4 (Measure)**, Channel Power, Ch Pwr Width

[:SENSe]:CHPower:STATe OFF|ON|0|1
[:SENSe]:CHPower:STATe?

Title: Channel Power Measurement 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: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Related Command: `:CONFigure:ACPower`

Front Panel Access: **Shift-4 (Measure)**, Channel Power, On/Off

[:SENSe]:CORRection:IMPedance[:INPut]:OFFSet <rel ampl>
[:SENSe]:CORRection:IMPedance[:INPut]:OFFSet?

Title: Other Input Impedance Loss

Description: Sets the value that is used for amplitude correction when the value set by [:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] is something other than 50 or 75. This value is not applied if the impedance is set to either 50 or 75.

Parameter: `<rel ampl>`

Default Value: 0

Default Unit: dB

Range: 0 dB to 100 dB

Related Command: `:CORRection:IMPedance[:INPut][:MAGNitude]`

Front Panel Access: **Shift-8 (System)**, Application Options, Impedance

[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] <integer>
[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?

Title: Input Impedance

Description: Sets the input impedance that is used for amplitude correction and conversion between units (dBm vs. dBV vs. Volts, etc.). If the value of <integer> is 50 no correction is performed. If the value of <integer> is 75 correction is done based on Anritsu adapter 12N50-75B.

Parameter: `<integer>`

Parameter Type: <integer>

Default Value: 50

Range: 50, 75 all other values are treated as described above

Related Command: `:BANDwidth|BWIDth:VIDeo:RATio`

Front Panel Access: **Shift-8 (System)**, Application Options, Impedance

[:SENSe]:DETector[:FUNCtion] POSitive|RMS|NEGative|SAMPle
[:SENSe]:DETector[:FUNCtion]?

Title: Detection Type

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. SAMPle detection displays the "middle" point of those measurements associated with a display point. For example, if there are 3 measurement frequencies associated with a given display point, sample detection will display the value at the frequency of the second measurement point.

Parameter: `POSitive|RMS|NEGative|SAMPle`

Parameter Type: <char>

Default Value: (Positive) Peak

Front Panel Access: **Amplitude**, Detection

[:SENSe]:FREQuency:CENTer <freq>
[:SENSe]:FREQuency:CENTer?

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.

Parameter: `<freq>`

Default Unit: Hz

Front Panel Access: **Freq**, Center Freq

[:SENSe]:FREQuency:SIGStandard:CHANnel <number>
[:SENSe]:FREQuency:SIGStandard:CHANnel?

Title: Channel Selection

Description: Sets the channel number for the selected signal standard.

Parameter: `<number>`

Front Panel Access: **Freq**, Channel

[:SENSe]:FREQuency:SIGStandard:NAMe <string>
[:SENSe]:FREQuency:SIGStandard:NAMe?

Title: Signal Standard

Description: Selects the desired signal standard from the list. The <string> argument is the name of the desired signal standard as displayed in the instrument's current signal standard list. The list can be displayed on the instrument by choosing the Signal Standard submenu button in the Freq menu. The list can also be downloaded remotely and viewed using Anritsu Master Software Tools. For example, if the desired Signal Standard is P-GSM 900 - Uplink then the value of the <string> argument would be "P-GSM 900 - Uplink".

The query form of this command will return the name of the currently selected Signal Standard on the list.

Parameter: `<string>`

Front Panel Access: **Freq**, Signal Standard

[:SENSe]:FREQuency:SPAN <freq>
[:SENSe]:FREQuency:SPAN?

Title: Frequency 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.

Parameter: `<freq>`

Default Unit: Hz

[:SENSe]:FREQuency:SPAN:FULL

Title: Frequency Span – Full

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.

Front Panel Access: **Span**, Full Span

[:SENSe]:FREQuency:SPAN:PREVious

Title: Frequency Span – Last

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.

Default Unit: Hz

Front Panel Access: **Span**, Last Span

[:SENSe]:FREQuency:STARt <freq>
[:SENSe]:FREQuency:STARt?

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.

Parameter: <freq>

Default Value: 0 Hz

Default Unit: Hz

Related Command: :FREQuency:STOP?

Front Panel Access: **Freq**, Start Freq

[:SENSe]:FREQuency:STEP[:INCRement] <freq>
[:SENSe]:FREQuency:STEP[:INCRement]?

Title: Frequency Step

Description: Sets the frequency step to the given frequency value.

Parameter: <freq>

Default Value: 1 MHz

Default Unit: Hz

Range: 1 Hz to 20 GHz

Front Panel Access: **Freq**, Step Size & Offset, Freq Step

Note	Setting the frequency step size above the maximum span of the instrument will cause the maximum value to be set for the Center Freq, Start Freq or Stop Freq submenu key when the up arrow key is pressed and the minimum value set when the down arrow key is pressed.

[:SENSe]:FREQuency:STOP <freq>
[:SENSe]:FREQuency:STOP?

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.

Parameter: <freq>

Default Unit: Hz

[:SENSe]:FSTRength:ANTenna <antenna>
[:SENSe]:FSTRength:ANTenna?

Title: Field Strength Antenna

Description: Selects an antenna from the antenna list to use for field strength measurement result calculations. The <antenna> argument is a 1-based index of the position of the desired antenna in the instrument's current antenna list. The list can be displayed on the instrument by choosing the "Antenna" submenu button in the "F Strength" menu. For example, if the desired antenna were the 3rd item on the antenna listing then the value of the <antenna> argument would be 3.

The query form of this command will return the index of the currently selected antenna.

Note	An invalid selection will return a zero when queried.

Parameter: `<antenna>`

Default Value: 1

Related Command: `:CONFigure:FSTRength`

Front Panel Access: **Shift-4 (Measure)**, Field Strength, Antenna

[:SENSe]:FSTRength:STATe OFF|ON|0|1
[:SENSe]:FSTRength:STATe?

Title: Field Strength Measurement State

Description: Sets the state of the field strength measurement, ON or OFF. When using :CONFigure:FSTRength, the state is automatically set to ON.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Related Command: `:CONFigure:CHPower`

Front Panel Access: **Shift-4 (Measure)**, Field Strength, On/Off

[:SENSe]:OBWidth:METHod XDB|PERCent
[:SENSe]:OBWidth:METHod?

Title: Occupied Bandwidth Measurement 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.

Parameter: `XDB|PERCent`

Parameter Type: <char>

Default Value: PERCent

Related Command: `:OBWidth:XDB :OBWidth:PERCent`

Front Panel Access: **Shift-4 (Measure)**, OCC BW

[:SENSe]:OBWidth:PERCent <percentage>
[:SENSe]:OBWidth:PERCent?

Title: Occupied Bandwidth Percent of Power

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.

Parameter: `<percentage>`

Default Value: 99

Default Unit: %

Range: 0% to 100%

Related Command: `:OBWidth:METHod`

Front Panel Access: **Shift-4 (Measure)**, OCC BW, %

[:SENSe]:OBWidth:STATe OFF|ON|0|1
[:SENSe]:OBWidth:STATe?

Title: Occupied Bandwidth Measurement State

Description: Sets the state of the occupied bandwidth measurement, ON or OFF. When using :CONFigure:OBWidth, the state is automatically set to ON.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Related Command: `:CONFigure:OBWidth`

Front Panel Access: **Shift-4 (Measure)**, OCC BW, On/Off

[:SENSe]:OBWidth:XDB <rel ampl>
[:SENSe]:OBWidth:XDB?

Title: Occupied Bandwidth dB Down

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.

Parameter: `<rel ampl>`

Default Value: 3 dBc

Default Unit: dBc

Range: 0 to 100 dBc

Related Command: `:OBWidth:METHod`

Front Panel Access: **Shift-4 (Measure)**, OCC BW, dBc

[:SENSe]:OPTion:IF:BWSTate 1|2|3|4|5
:SENSe:OPTion:IF:BWSTate?

Title: IF Bandwidth State

Description: Sets the IF Bandwidth. Setting a value of 1 is equivalent of setting the IF Bandwidth to Normal on the front panel. Setting a value of 3 is equivalent of setting the IF Bandwidth to 10 MHz BW on the front panel. Setting the value of 4 is equivalent of setting the IF Bandwidth to 16 MHz BW on the front panel. Note that option 89 must be available and in Zero span for the command to be valid. The query version of this command will return a 0 if not in zero span.

Parameter: `1|2|3|4|5`

Range: 1|2|3|4|5

[:SENSe]:POWer[:RF]:ATTenuation <rel ampl>
[:SENSe]:POWer[:RF]:ATTenuation?

Title: Input Attenuation

Description: Sets the input attenuation. Note that issuing this command will set the automatic input attenuation OFF.

Parameter: `<rel ampl>`

Default Value: 30 dB

Default Unit: dB

Range: 0 dB to 65 dB

Related Command: `:POWer[:RF]:ATTenuation:AUTO`

Front Panel Access: **Amplitude**, Atten Lvl

[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:ATTenuation:AUTO?

Title: Input Attenuation Coupling

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 un-coupled 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: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON

Related Command: `:POWer[:RF]:ATTenuation`

Front Panel Access: **Amplitude**, Auto Atten

[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF|ON|0|1
[:SENSe]:POWer[:RF]:GAIN[:STATe]?

Title: Preamp State

Description: Sets the state of the preamp. Note that this may cause a change in the reference level and/or attenuation.

Note: The MS2711E returns a value of -1 if Preamp (Option 8) is not installed.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: OFF

Front Panel Access: **Amplitude**, Pre Amp

[:SENSe]:SWEep:MODE FAST|PERFormance|NOFFt
[:SENSe]:SWEep:MODE?

Title: Sweep Mode

Description: Sets the sweep mode to Fast, Performance or No FFT. The query from of this command returns the current sweep mode short form.

Note: FAST Sweep Mode is not available for the MS2711E.

Parameter: `FAST|PERFormance|NOFFt`

Parameter Type: <char>

Front Panel Access: **Shift-3 (Sweep)**, Sweep Mode

[:SENSe]:SWEep:STATus?

Description: This command queries the sweep complete status. Returns 1 when the sweep is complete. Returns 0 when the sweep is in progress.

Cmd Parameter: **NA**

Query Response: 0 | 1

Related Command: `:STATus:OPERation?`

Front Panel Access: **NA**

[:SENSe]:SWEep:TIME[:LLIMit]
[:SENSe]:SWEep:TIME[:LLIMit]?

Title: Minimum Sweep Time

Description: Sets the value of the minimum sweep time parameter. The sweep will complete in the shortest time possible greater than the specified time. To sweep as fast as possible, enter the minimum value allowed for the sweep time.

Default Value: 0.001

Default Unit: Seconds

Range: 10 µs to 600000000 µs

Front Panel Access: **Shift-3 (Sweep)**, Sweep Time

[:SENSe]:SWEep:TIME:ACTual?

Title: Actual Sweep Time

Description: Returns the actual sweep time as opposed to the specified sweep time.

Default Unit: Seconds

[:SENSe]:SWEep:TIME:AUTO ON|OFF|1|0
[:SENSe]:SWEep:TIME:AUTO?

Title: Auto Sweep Time

Description: Sets Auto Sweep Time on or off.

Front Panel Access: **Shift-3 (Sweep)**, Auto Sweep Time

Chapter 5 — VNA Commands

5-1 Introduction

This chapter describes commands for LMR Master mode. Only the commands that are listed in this chapter and in Chapter 3, "All Mode Commands" can be used in LMR Master mode. Using commands from other modes may produce unexpected results.

Note	Front Panel Access in VNA mode via the function hard keys may be listed as **Freq/Dist** or as **Freq**. The first function hard key is displayed with the label **Freq/Dist**.

5-2 :CALCulate Subsystem

The commands in this subsystem process data that have been collected via the :CALCulate subsystem.

:CALCulate<Tr>:DATA? FDATa|SDATa|FMEM|SMEM

Description: Transfers the given trace data specified by `<Tr>` from the instrument to the controller. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

`FDATa:` Formatted (or Final) data. The returned data are based on the Graph Type that is associated with the trace. For graph types that use only one number per point (such as Log Mag, SWR, Phase, Real, Imaginary, Group Delay, Log Mag/2), the command returns one number per data point. For graph types that use two numbers per point (such as Smith Chart), the command returns two numbers per data point. Following is a list of the returned values for each Graph Type:

Table 5-1. Graph Type and Returned Units (Sheet 1 of 2)

Graph Type	Returned Units
Log Magnitude	dB
Log Magnitude/2	dB
Phase	degree
SWR	unitless
Real	unitless
Imaginary	unitless
Group Delay	ns (nanosecond)
Smith Chart	R + jX ohm
Linear Polar	unitless, degree
Log Polar	dB, degree

Table 5-1. Graph Type and Returned Units (Sheet 2 of 2)

Graph Type	Returned Units
Real Impedance	ohm
Imaginary Impedance	ohm

SDATa: Complex measurement data. The returned numbers (which are independent of the Graph Type that is associated with the trace) are the complex measurement data (Real and Imaginary) for each point of the trace. A 551 point trace therefore has a total of 1102 points that get transferred.

FMEM: Formatted (or Final) Memory data. Similar to FDATa, but for memory data.

SMEM: Complex memory data. Similar to SDATa, but for memory data.

Note that in order to get valid data when querying for memory data, you must first store a trace into memory using the command CALC:MATH:MEMorize. The format of the block data that is returned can be specified by the command :FORMat:DATA. The response begins with an ASCII header that specifies the number of data bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header. Each data point is separated by a comma delimiter.

Cmd Parameter: **NA** (query only)

Query Parameter: <char> FDATa|SDATa|FMEM|SMEM

Query Response: <block> (returns block data)

Related Command: :FORMat:DATA

Front Panel Access: **NA**

:CALCulate:FORMat Subsystem

Commands in this subsystem define the display format for a measurement.

:CALCulate<Tr>:FORMat <Graph Type>
:CALCulate<Tr>:FORMat?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`LMAGnitude|SWR|PHASe|REAL|IMAGinary|GDELay|SMITh|LM/2|LINPolar|LOGPolar|RIMPedance|IIMPedance`

The query version of this command returns "LMAG" if the specified trace graph type is set to Log Mag, "SWR" if set to SWR, "PHAS" if set to Phase, "REAL" if set to Real, "IMAG" if set to Imaginary, "GDEL" if set to Group Delay, and "SMIT" is set to Smith chart, and "LM/2" if set to Log Mag/2 (cable loss), "LINP" if set to Linear Polar, "LOGP" if set to Log Polar, "RIMP" if set to Real Impedance, and "IIMP" if set to Imaginary Impedance.

Cmd Parameter: `<char> <Graph Type> (LMAGnitude|SWR|PHASe|REAL|IMAGinary|GDELay|SMITh|LM/2|LINPolar|LOGPolar|RIMPedance|IIMPedance)`

Query Response: `<char> <Graph Type> (LMAG|SWR|PHAS|REAL|IMAG|GDEL|SMIT|LM/2|LINP|LOGP|RIMP|IIMP)`

Default Value: Trace 1: SMIT

Trace 2: LMAG

Trace 3: LMAG

Trace 4: SMIT

Example: To set Trace 2 graph type to Log Magnitude

`:CALC2:FORM LMAG`

Front Panel Access: **Measure**, Graph Type

:CALCulate:LIMit Subsystem

This subsystem defines the limit lines and controls the limit check.

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

Description: Enables/disables the active trace currently selected limit line alarm. Setting the value to `ON` or `1` turns on the active trace limit alarm. Setting the value to `OFF` or `0` turns off the active trace limit alarm. The query version of the command returns a `1` if the active trace currently selected limit line alarm is set to `ON` and returns `0` if set to `OFF`. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: OFF or 0 (query returns 0 for OFF)

Example: To turn off limit alarm

```
:CALCulate:LIMit:ALARm OFF
:CALCulate:LIMit:ALARm 0
```

To turn on limit alarm

```
:CALCulate:LIMit:ALARm ON
:CALC:LIM:ALAR 1
```

Related Command: `:CALCulate:LIMit:TYPE`

Front Panel Access: **Shift 6** (Limit), Limit Alarm

:CALCulate<Tr>:LIMit:LOWer:POINt?

Description: Returns the number of points currently in the lower limit line of the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameter: **NA** (query Only)

Query Response: `<NR1> <integer>`

Example: To query for the lower limit total point on trace #2:

```
:CALC2:LIM:LOW:POIN?
```

Front Panel Access: **NA**

:CALCulate<Tr>:LIMit:LOWer:POINt:ADD

Description: Adds a new limit point to the lower limit line of the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Example: To add a point to the lower limit line on trace 2:

`:CALC2:LIM:LOW:POIN:ADD`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Add Point

:CALCulate<Tr>:LIMit:LOWer:POINt:DELete

Description: Deletes the lower limit point of the given trace `<Tr>`. After deletion, the point that is immediately to the left of the point that was deleted becomes the active point. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. Note that deletion is valid only if more than 2 limit points are present.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Example: To delete the trace 4 lower limit current active point:

`:CALCulate4:LIMit:LOWer:POINt:DELete`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Delete Point

:CALCulate<Tr>:LIMit:LOWer:POINt:LEFT

Description: Sets the limit point to the left of the lower limit active point of the given trace `<Tr>` as the new active point. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Example: To make the lower limit point to the left of the current active point of trace 2 as the new active point:

`:CALCulate2:LIMit:LOWer:POINt:LEFT`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Next Point Left

:CALCulate<Tr>:LIMit:LOWer:POINt:RIGHt

Description: Sets the limit point to the right of the lower limit active point of the given trace `<Tr>` as the new active point. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Example: To make the lower limit point to the right of the current active point of trace 2 as the new active point:

```
:CALCulate2:LIMit:LOWer:POINt:RIGHt
```

Front Panel Access: **Shift 6** (Limit), Limit Edit, Next Point Right

:CALCulate<Tr>:LIMit:LOWer:POINt:X <x-parameter>
:CALCulate<Tr>:LIMit:LOWer:POINt:X?

Description: Sets the location of the lower limit point of the given trace `<Tr>` on the x-axis at the specified location. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<x-parameter>` is defined in the current x-axis. Sending the set command changes the Move Limit on the front panel to Point if it is currently set to Limit, and sets the given trace as the active trace. The `<x-parameter>` given unit must correspond to the given trace domain type. If no unit is specified with the `<x-parameter>`, then the default unit is used. The query version of the command returns the location of the given trace active lower limit point on the x-axis followed by the unit. If an error occurs, such as limit not `ON`, then the query version of the command returns –400 error codes. Limit line must be `ON` for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <x-parameter> (hertz, meters, feet)`

Query Response: `<NR3> <x-parameter> (hertz, meters, feet)`

Default Units: Hz for Frequency domain,
Meters or Feet for distance domain.

Example: To set the trace 4 lower limit point to 5000 Hertz (trace 4 in frequency domain):

`:CALCulate4:LIMit:LOWer:POINt:X 5000`

OR to 500 MHz:

`:CALCulate4:LIMit:LOWer:POINt:X 500 MHz`

To set the trace 1 lower limit point to 5 Feet (trace 1 in distance domain with current distance unit in meter):

`:CALCulate:LIMit:LOWer:POINt:X 5 FT`

OR to 4 Meter

`:CALCulate1:LIMit:LOWer:POINt:X 4 M`

OR to 4 Meter

`:CALCulate:LIMit:LOWer:POINt:X 4`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Limit X

:CALCulate<Tr>:LIMit:LOWer:POINt:Y <y-parameter>
:CALCulate<Tr>:LIMit:LOWer:POINt:Y?

Description: Sets the location of the lower limit point of the given trace `<Tr>` on the y-axis at the specified location. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified then default is trace number 1. Sending the set command changes the Move Limit on the front panel to Point if it is currently set to Limit, and sets the given trace as the active trace. The `<y-parameter>` is defined in the given trace current y-axis. If no unit is specified with the `<y-parameter>`, then the default unit is used. The query version of the command returns the location of the given trace lower limit point on the y-axis. If an error occurs, such as limit not `ON`, then the query version of the command returns –400 error codes. Limit line must be ON for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <y-parameter> (depends on display type)`

Query Response: `<NR3> <y-parameter> (depends on display type)`

Default Units: Current active trace y-axis unit

Related Command: `:CALCulate:LIMit:TYPE`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Amplitude

:CALCulate<Tr>:LIMit:LOWer[:STATe] OFF|ON|0|1
:CALCulate<Tr>:LIMit:LOWer[:STATe]?

Description: Turns the lower limit line of the given trace `<Tr>` ON or OFF. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. The query version of the command returns a 1 if the lower limit line of the given trace is ON, and returns a 0 if it is OFF.

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: OFF or 0 (query returns 0 for OFF)

Example: To turn on lower limit of trace 1

```
:CALCulate:LIMit:LOWer ON
:CALCulate1:LIMit:LOWer 1
:CALCulate:LIMit:LOWer:STATe ON
```

To turn off upper limit of trace 4

```
:CALCulate4:LIMit:LOWer OFF
:CALCulate4:LIMit:LOWer 0
:CALC4:LIM:LOW:STAT 0
```

Related Command: `:CALCulate:LIMit[:STATe]`

Front Panel Access: **Shift 6** (Limit), Limit State

:CALCulate<Tr>:LIMit:LOWer:X <x-parameter>
:CALCulate<Tr>:LIMit:LOWer:X?

Description: Moves the lower limit of the given trace `<Tr>` on the x-axis to the given value. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<x-parameter>` is defined in the given trace current x-axis. The unit given with the `<x-parameter>` must correspond to the given trace domain type. If no unit is specified with the `<x-parameter>`, then the default unit is used. The set version of the command changes the Move Limit on the front panel to Limit if it is currently set to Point, and sets the given trace as the active trace. The query version of the command returns the location of the given trace lower limit point on the x-axis followed by the unit. If an error occurs, such as limit not `ON`, then the query version of the command returns –400 error codes. Limit line must be ON for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <x-parameter> (hertz, meters, feet)`

Query Response: `<NR3> <x-parameter> (hertz, meters, feet)`

Default Units: Hz for Frequency domain,
Meters or Feet for distance domain.

Example: To move the trace 4 lower limit to 5000 Hertz (trace 4 in frequency domain)

`:CALCulate4:LIMit:LOWer:X 5000`

OR to 500 MHz:

`:CALCulate4:LIMit:LOWer:X 500 MHz`

To move the trace 1 lower limit to 5 Feet (trace 1 in distance domain with current distance unit in meter)

`:CALCulate:LIMit:LOWer:X 5 FT`

OR to 4 Meter

`:CALCulate1:LIMit:LOWer:X 4 M`
`:CALCulate:LIMit:LOWer:X 4`

Related Command: `:CALCulate:LIMit[:STATe]`
`:CALCulate<Tr>:LIMit:LOWer:Y`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Limit X

:CALCulate<Tr>:LIMit:LOWer:Y <y-parameter>
:CALCulate<Tr>:LIMit:LOWer:Y?

Description: Sets the location of the lower limit line of the given trace `<Tr>` on the y-axis at the given value. This moves the entire lower limit and moves the current active limit point by the given value. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. The `<y-parameter>` is defined in the current y-axis. If no unit is specified with the `<y-parameter>`, then the default unit is used. The set version of the command changes the Move Limit on the front panel to Limit if it is currently set to Point, and sets the given trace as the active trace. The query version of the command returns the location of the active limit point on the y-axis. If an error occurs, such as limit not `ON`, then the query version of the command returns a –400 error codes. Limit line must be ON for the command to be valid.

Cmd Parameter: `<NRf> <y-parameter> (depends on display type)`

Query Response: `<NR3> <y-parameter> (depends on display type)`

Default Units: Current active trace y-axis unit

Related Command: `:CALCulate:LIMit[:STATe]`
`:CALCulate3:LIMit:LOWer:X`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Amplitude

:CALCulate:LIMit:POINt?

Description: Returns the number of points currently in the selected limit line. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: **NA** (query only)

Query Response: `<NR1> <integer>`

Related Command: `:CALCulate:LIMit:TYPE`

Front Panel Access: **NA**

:CALCulate:LIMit:POINt:ADD

Description: Adds a new limit point to the currently active limit line. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Related Command: `:CALCulate:LIMit:TYPE`
`:CALCulate:LIMit:POINt:DELete`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Add Point

:CALCulate:LIMit:POINt:DELete

Description: Deletes the active trace active limit point. After deletion, the point that is immediately to the left of the point that was deleted becomes the active point. Note that deletion is valid only if 2 or more limit points exist. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Example: To delete the currently active limit point

`:CALCulate:LIMit:POINt:DELete`

Related Command: `:CALCulate:LIMit:POINt:ADD`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Delete Point

:CALCulate:LIMit:POINt:LEFT

Description: Sets the limit point immediately to the left of the active limit point as the active point. This makes it active for editing or deleting. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Example: To select the point to the left of the active point

`:CALCulate:LIMit:POINt:LEFT`

Related Command: `:CALCulate:LIMit:POINt:RIGHt`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Next Point Left

:CALCulate:LIMit:POINt:RIGHt

Description: Sets the limit point immediately to the right of the active limit point as the active point. This makes it active for editing or deleting. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Example: To select the point to the right of the active point:

`:CALCulate:LIMit:POINt:RIGHt`

Related Command: `:CALCulate:LIMit:POINt:LEFT`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Next Point Right

:CALCulate:LIMit:POINt:X <x-parameter>
:CALCulate:LIMit:POINt:X?

Description: Sets the location of the active limit point on the x-axis at the specified location. Sending this command changes the Move Limit on the front panel to Point if it is currently set to Limit. The `<x-parameter>` must correspond to the current active trace domain type. If no unit is specified with the `<x-parameter>`, then the default unit is used. The query version of the command returns the location of the active limit point on the x-axis followed by the unit. If an error occurs, such as limit not `ON`, then the query version of the command returns −400 error codes. Limit line must be ON for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <x-parameter> (hertz, meters, feet)`

Query Response: `<NR3> <x-parameter> (hertz, meters, feet)`

Default Units: Hz for Frequency domain,
Meters or Feet for distance domain.

Example: To set the active limit point to 5000 Hertz (active trace in frequency domain):

```
:CALCulate:LIMit:POINt:X 5000
```

OR to 500 MHz:

```
:CALCulate:LIMit:POINt:X 500 MHz
```

To set the active limit point to 5 Feet (active trace in distance domain with current distance unit in meter):

```
:CALCulate:LIMit:POINt:X 5 FT
```

OR to 4 Meter

```
:CALCulate:LIMit:POINt:X 4 M
:CALCulate:LIMit:POINt:X 4
```

Related Command: `:CALCulate:LIMit:POINt:Y`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Limit X

:CALCulate:LIMit:POINt:Y <y-parameter>
:CALCulate:LIMit:POINt:Y?

Description: Sets the location of the active limit point on the y-axis at the specified location. Sending this command changes the Move Limit on the front panel to Point if it is currently set to Limit. The `<y-parameter>` is defined in the current y-axis. If no unit is specified with the `<y-parameter>`, then the default unit is used. The query version of the command returns the location of the active limit point on the y-axis. If an error occurs, such as limit not ON, the query version of the command returns an error code of –400. Limit line must be ON for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <y-parameter> (depends on display)`

Query Response: `<NR3> <y-parameter> (depends on display)`

Default Units: Current active trace y-axis unit

Related Command: `:CALCulate:LIMit:POINt:X`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Amplitude

:CALCulate:LIMit[:STATe] OFF|ON|0|1
:CALCulate:LIMit[:STATe]?

Description: Turns the active trace currently selected limit line (upper or lower) ON or OFF. If the value is set to ON or 1, then the active trace selected limit line is turned ON. If the value is set to OFF or 0, then the active trace selected limit line is turned OFF. The query version of the command returns a 1 if the active trace selected limit line is ON and returns a 0 if it is OFF. Use `:CALCulate:LIMit:TYPe` to set the currently active limit line.

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: OFF or 0 (query returns 0 for OFF)

Example: To turn on the currently selected limit line:

```
:CALCulate:LIMit ON
:CALCulate:LIMit:STATe ON
:CALCulate:LIMit:STATe 1
```

To turn off the currently selected limit line:

```
:CALCulate:LIMit OFF
:CALCulate:LIMit:STATe 0
:CALCulate:LIMit 0
```

Front Panel Access: **Shift 6** (Limit), Limit State

:CALCulate:LIMit:TYPE 0|1
:CALCulate:LIMit:TYPE?

Description: Sets the limit line segment type (upper or lower) to be edited. Set the value to 1 for Lower limit segment and to 0 for Upper limit line segment. The query version of the command returns a 1 if the lower limit line is currently active for editing and returns a 0 if the upper limit line is currently active for editing.

Cmd Parameter: `<char> 0|1`

Query Response: `<char> 0|1`

Default Value: 0

Example: To set upper limit line active for editing:

`:CALCulate:LIMit:TYPE 0`

To set lower limit line active for editing:

`:CALCulate:LIMit:TYPE 1`

Front Panel Access: **Shift 6** (Limit), Limit

:CALCulate<Tr>:LIMit:UPPer:POINt?

Description: Query only. Returns the number of points currently in the upper limit line of the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Syntax: `:CALCulate<Tr>:LIMit:UPPer:POINt?`

Cmd Parameter: **NA** (query only)

Query Response: `<NR1> <integer>`

Example: To query for the upper limit line total point on trace #2:

`:CALC2:LIM:UPP:POIN?`

Front Panel Access: **NA**

:CALCulate<Tr>:LIMit:UPPer:POINt:ADD

Description: Adds a new limit point to the upper limit line of the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Parameter: **NA**

Query Syntax: **NA** (no query)

Query Response: **NA**

Example: To add a point to the upper limit line on trace 2:

`:CALC2:LIM:UPP:POIN:ADD`

Related Command: `:CALCulate<Tr>:LIMit:UPPer:POINt:DELete`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Add Point

:CALCulate<Tr>:LIMit:UPPer:POINt:DELete

Description: Deletes the upper limit point of the given trace `<Tr>`. After deletion, the point that is immediately to the left of the point that was deleted becomes the active point. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. Note that deletion is valid only if 2 or more limit points are active.

Parameter: **NA**

Query Syntax: **NA** (no query)

Query Response: **NA**

Example: To delete trace 3 upper limit current active point:

```
:CALCulate3:LIMit:UPPer:POINt:DELete
```

Related Command: `:CALCulate<Tr>:LIMit:UPPer:POINt:ADD`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Delete Point

:CALCulate<Tr>:LIMit:UPPer:POINt:LEFT

Description: Sets the limit point to the left of the upper limit active point of the given trace `<Tr>` as the new active point. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Parameter: **NA**

Query Syntax: **NA** (no query)

Query Response: **NA**

Example: To make the upper limit point to the left of the current active point of trace 2 as the new active point:

```
:CALCulate2:LIMit:UPPer:POINt:LEFT
:CALC2:LIM:UPP:POIN:LEFT
```

Related Command: `:CALCulate<Tr>:LIMit:UPPer:POINt:RIGHt`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Next Point Left

:CALCulate<Tr>:LIMit:UPPer:POINt:RIGHt

Description: Sets the limit point to the right of the upper limit active point of the given trace `<Tr>` as the new active point. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified than defaults to trace number 1.

Parameter: **NA**

Query Syntax: **NA** (no query)

Query Response: **NA**

Example: To make the upper limit point to the right of the current active point of trace 2 as the new active point:

```
:CALCulate2:LIMit:UPPer:POINt:RIGHt
:CALC2:LIM:UPP:POIN:RIGH
```

Related Command: `:CALCulate<Tr>:LIMit:UPPer:POINt:LEFT`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Next Point Right

:CALCulate<Tr>:LIMit:UPPer:POINt:X <x-parameter>
:CALCulate<Tr>:LIMit:UPPer:POINt:X?

Description: Sets the location of the upper limit point of the given trace `<Tr>` on the x-axis at the specified location. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified than defaults to trace number 1. Sending the set command will change the Move Limit on the front panel to Point if it is currently set to Limit and set the given trace as the active trace. <x-parameter> is defined in the given trace current x-axis. The given unit must correspond to the given trace domain type. If no unit is specified with the <x-parameter> then the default unit will be used. The query version of the command returns the location of the given trace upper limit point on the x-axis followed by the unit. If an error occurs, such as limit not ON, the query version of the command returns an error code of –400. Limit line must be on for the command to be valid. Use `:CALCulate:LIMit:TYPe` to set the currently active limit line.

Cmd Parameter: `<NRf> <x-parameter> (hertz, meters, feet)`

Query Response: `<NR3> <x-parameter> (hertz, meters, feet)`

Default Units: Hz for Frequency domain,
Meters or Feet for distance domain.

Example: To set the trace 4 upper limit point to 5000 Hertz (trace 4 in frequency domain):

```
:CALCulate4:LIMit:UPPer:POINt:X 5000
```

OR to 500 MHz:

```
:CALCulate4:LIMit:UPPer:POINt:X 500 MHz
```

To set the trace 1 upper limit point to 5 Feet (trace 1 in distance domain with current distance unit in meter):

`:CALCulate:LIMit:UPPer:POINt:X 5 FT`

OR to 4 Meter

```
:CALCulate1:LIMit:UPPer:POINt:X 4 M
:CALCulate:LIMit:UPPer:POINt:X 4
```

Related Command: `:CALCulate:LIMit:TYPe`
`:CALCulate<Tr>:LIMit:UPPer:POINt:Y`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Limit X

:CALCulate<Tr>:LIMit:UPPer:POINt:Y <y-parameter>
:CALCulate<Tr>:LIMit:UPPer:POINt:Y?

Description: Sets the location of the upper limit point of the given trace `<Tr>` on the y-axis at the specified location. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified than defaults to trace number 1. Sending the set command will change the Move Limit on the front panel to Point if it is currently set to Limit and set the given trace as the active trace. The <y-parameter> is defined in the given trace current y-axis. If no unit is specified with the <y-parameter> then the default unit will be used. The query version of the command returns the location of the given trace upper limit point on the y-axis. If an error occurs, such as limit not ON, the query version of the command returns an error code of –400. Limit line must be on for the command to be valid. Use `:CALCulate:LIMit:TYPe` to set the currently active limit line.

Cmd Parameter: `<NRf> <y-parameter> (depends on display type)`

Query Response: `<NR3> <y-parameter> (depends on display type)`

Default Units: Current active trace y-axis unit

Related Command: `:CALCulate:LIMit:TYPe`
`:CALCulate<Tr>:LIMit:UPPer:POINt:X`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Amplitude

:CALCulate<Tr>:LIMit:UPPer[:STATe] OFF|ON|0|1
:CALCulate<Tr>:LIMit:UPPer[:STATe]?

Description: Turns the upper limit line of the given trace `<Tr>` ON or OFF. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified than defaults to trace number 1. The query version of the command returns a 1 if the upper limit line of the given trace is ON and returns a 0 if the given trace is OFF.

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: OFF or 0 (query returns 0 for OFF)

Example: To turn on upper limit of trace 1:

```
:CALCulate:LIMit:UPPer ON
:CALCulate1:LIMit:UPPer 1
:CALCulate:LIMit:UPPer:STATe ON
```

To turn off upper limit of trace 4:

```
:CALCulate4:LIMit:UPPer OFF
:CALCulate4:LIMit:UPPer 0
:CALC4:LIM:UPP:STAT 0
```

Related Command: `:CALCulate:LIMit[:STATe]`

Front Panel Access: **Shift 6** (Limit), Limit State

:CALCulate<Tr>:LIMit:UPPer:X <x-parameter>
:CALCulate<Tr>:LIMit:UPPer:X?

Description: Moves the upper limit of the given trace `<Tr>` on the x-axis to the given value. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. <x-parameter> is defined in the given trace current x-axis. The unit given with the <x-parameter> must correspond to the given trace domain type. If no unit is specified with the <x-parameter> then the default unit will be used. The set version of the command will change the Move Limit on the front panel to Limit if it is currently set to Point and set the given trace as the active trace. The query version of the command returns the location of the given trace upper limit point on the x-axis followed by the unit. If an error occurs, such as limit not ON, the query version of the command returns an error code of –400. Limit line must be on for the command to be valid. Use the command `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <x-parameter> (hertz, meters, feet)`

Query Response: `<NR3> <x-parameter> (hertz, meters, feet)`

Default Units: Hz for Frequency domain,
Meters or Feet for distance domain.

Example: To move the trace 4 upper limit to 5000 Hertz (trace 4 in frequency domain):

```
:CALCulate4:LIMit:UPPer:X 5000
```

OR to 500 MHz:

```
:CALCulate4:LIMit:UPPer:X 500 MHz
```

To move the trace 1 upper limit to 5 feet (trace 1 in distance domain with current distance unit in meter):

```
:CALCulate:LIMit:UPPer:X 5 FT
```

OR to 4 Meter

```
:CALCulate1:LIMit:UPPer:X 4 M
:CALCulate:LIMit:UPPer:X 4
```

Related Command: `:CALCulate:LIMit:TYPe`
`:CALCulate<Tr>:LIMit:UPPer:Y`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Limit X

:CALCulate<Tr>:LIMit:UPPer:Y <y-parameter>
:CALCulate<Tr>:LIMit:UPPer:Y?

Description: Sets the location of the upper limit line of the given trace `<Tr>` on the y-axis at the given value. This moves the entire upper limit and moves the current active limit point by the given value. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified than defaults to trace number 1. The <y-parameter> is defined in the current y-axis. If no unit is specified with the <y-parameter> then the default unit will be used. The set version of the command will change the Move Limit on the front panel to Limit if it is currently set to Point and set the given trace as the active trace. The query version of the command returns the location of the active limit point on the y-axis. If an error occurs, such as limit not ON, the query version of the command returns an error code of –400. Limit line must be on for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <y-parameter> (depends on display type)`

Query Response: `<NR3> <y-parameter> (depends on display type)`

Default Units: Current active trace y-axis unit

Related Command: `:CALCulate:LIMit:TYPe`
`:CALCulate<Tr>:LIMit:UPPer:X`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Amplitude

:CALCulate:LIMit:X <x-parameter>
:CALCulate:LIMit:X?

Description: Sets the location of the active limit point on the x-axis at the specified location. This moves the entire limit and moves the active limit point to the given value. The <x-parameter> given unit must correspond to the current active trace domain type. If no unit is specified with the <x-parameter> then the default unit will be used. Sending the set command will change the Move Limit on the front panel to Limit if it is currently set to Point. The query version of the command returns the location of the active limit point on the x-axis followed by the unit. If an error occurs, such as limit not ON, the query version of the command returns an error code of –400. Limit line must be on for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <x-parameter> (hertz, meters, feet)`

Query Response: `<NR3> <x-parameter> (hertz, meters, feet)`

Default Units: Hz for Frequency domain,
Meters or Feet for distance domain.

Example: To move the active limit to 5000 Hertz (active trace in frequency domain):

```
:CALCulate:LIMit:X 5000
```

OR to 500 MHz:

`:CALCulate:LIMit:X 500MHz`

To move the active limit to 5 Feet (active trace in distance domain with current distance unit in feet):

`:CALCulate:LIMit:X 5FT`

OR to 4 Meter

```
:CALCulate:LIMit:X 4M
:CALCulate:LIMit:X 4
```

Related Command: `:CALCulate:LIMit:TYPe`
`:CALCulate:LIMit:Y`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Limit X

:CALCulate:LIMit:Y <y-parameter>
:CALCulate:LIMit:Y?

Description: Sets the location of the active limit line on the y-axis at the given value. This moves the entire limit and moves the current active limit point by the given value. Sending this command will change the Move Limit on the front panel to Limit if it is currently set to Point. The <y-parameter> is defined in the current y-axis. If no unit is specified with the <y-parameter> then the default unit will be used. The query version of the command returns the location of the active limit point on the y-axis. If an error occurs, such as limit not ON, the query version of the command returns an error code of –400. Limit line must be on for the command to be valid. Use `:CALCulate:LIMit:TYPE` to set the currently active limit line.

Cmd Parameter: `<NRf> <y-parameter> (depends on display type)`

Query Response: `<NR3> <y-parameter> (depends on display type)`

Default Units: Current active trace y-axis unit

Related Command: `:CALCulate:LIMit:TYPe`
`:CALCulate:LIMit:X`

Front Panel Access: **Shift 6** (Limit), Limit Edit, Amplitude

:CALCulate:MARKer Subsystem

This subsystem contains commands to manipulate data markers.

:CALCulate:MARKer:AOFF

Turns off all markers. This command will turn off all the markers and set Marker Type to off.

:CALCulate:MARKer:DATA?

Description: Reports the marker information. Each marker data is separated by a comma and data are returned similar to that when Readout Format is set to Table.

Cmd Parameter: **NA** (query only)

Query Response: `<char> (comma separated data)`

Front Panel Access: **NA**

:CALCulate:MARKer[1]|2|3|4|5|6|7|8:DELTa:REFerence <Mk>
:CALCulate:MARKer[1]|2|3|4|5|6|7|8:DELTa:REFerence?

Description: Sets the specified delta marker reference to the given reference marker specified by `<Mk>`. `<Mk>` is the reference marker number in the range of 1 to 8. The query version of the command returns the reference marker number to which the specified delta marker should be referenced. If the selected marker is not a delta marker, then –230 is returned. Note that the set version of this command will set the specified delta marker as the active marker. The given reference marker number must be currently set as a reference marker and the specified delta marker number must currently be set as delta marker. Also both markers (delta and reference) must be in the same domain type.

Cmd Parameter: `<char> <Mk>`

Query Response: `<char> <Mk>`

Default Value: –230 (The selected marker is a reference marker)

Example: Set Marker 1 as the reference marker of delta Marker 3:

```
:CALCulate:MARKer3:DELTa:REFerence 1
:CALC:MARK3:DELT:REF 1
```

Related Command: `:CALCulate:MARKer<Mk>:TYPE`, `:CALCulate:MARKer<Mk>:DOMain?`

Front Panel Access: **Marker**, Avail Ref Mkr

:CALCulate:MARKer[1]|2|3|4|5|6|7|8:DELTa[:STATe] OFF|ON|0|1
:CALCulate:MARKer[1]|2|3|4|5|6|7|8:DELTa[:STATe]?

Description: Sets the specified marker as the active marker and turn it on or off. If the value is set to ON or 1, then the specified marker is turn on and set as a delta marker. If the value is set to OFF or 0, then the specified marker is turn off. The query version of the command returns a 1 if the specified marker is a delta marker, and returns a 0 if it is not a delta marker.

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: OFF

Example: To turn on marker #3 and set it as a delta marker:

```
:CALCulate:MARKer3:DELTa ON
:CALCulate:MARKer3:DELTa 1
:CALCulate:MARKer3:DELTa:STATe ON
:CALCulate:MARKer3:DELTa:STATe 1
```

To turn off delta marker #6:

```
:CALCulate:MARKer6:DELTa OFF
:CALCulate:MARKer6:DELTa:STATe OFF
:CALCulate:MARKer6:DELTa:STATe 0
```

Related Command: `:CALCulate:MARKer:DELTa:REFerence`

Front Panel Access: **Marker**, Maker Type

:CALCulate:MARKer:DISPlay:FORMat NONE|SCREen|TABLe|TRACe
:CALCulate:MARKer:DISPlay:FORMat?

Description: Sets the display readout format for markers. The query version of the command returns “NONE” if the display readout format is set to None, “SCRE” if Screen, “TABL” if Table, and “TRAC” if Trace.

Cmd Parameter: `<char> NONE|SCREen|TABLe|TRACe`

Query Response: `<char> NONE|SCRE|TABL|TRAC`

Default Value: NONE

Example: To set marker readout format to Table:

```
:CALCulate:MARKer:DISPlay:FORMat TABLe
:CALCulate:MARKer:DISPlay:FORMat TABL
:CALC:MARK:DISP:FORM TABL
```

Front Panel Access: **Marker**, Readout Format

:CALCulate:MARKer<Mk>:DOMain?

Description: Query the specified marker `<Mk>` domain type. `<Mk>` is the marker number in the range of 1 to 8. If no marker number is specified, then the marker number (the `<Mk>` value) defaults to 1. This command returns "FREQ" if the specified marker domain is frequency and "DIST" if distance.

Cmd Parameter: **NA** (query only)

Query Response: `<char> FREQ|DIST`

Front Panel Access: **NA**

:CALCulate:MARKer<Mk>:FORMat <Style>
:CALCulate:MARKer<Mk>:FORMat?

Description: Sets the specified marker `<Mk>` readout style. `<Mk>` is the marker number in the range of 1 to 8. If no marker number is specified, then the marker number (the `<Mk>` value) defaults to 1. `<Style>` is the marker readout style and must be one of the following values:

`GRAPh|LMAGnitude|LOGPhase|PHASe|RLIMaginary|SWR|`
`IMPedance||ADMittance|NIMPedance|NADMittance|`
`PIMPedance|GDELay|LM/2|LINMagnitude|LINPhase`

The query version of the command returns `"GRAP"` if the specified marker readout style is set to Graph Type, `"LMAG"` if the specified marker readout style is set to Log Magnitude, `"LOGP"` if Log Mag and Phase, `"PHAS"` if Phase, `"RLIM"` if Real and Imaginary, `"SWR"` if standing wave ratio, `"IMP"` for impedance, `"ADM"` for admittance, `"NIMP"` for normalized impedance, `"NADM"` for normalized admittance, `"PIMP"` for polar impedance, `"GDEL"` if group delay, `"LM/2"` for log mag/2 (cable loss), `"LINM"` for Linear Magnitude (Lin Mag), and `"LINP"` for Linear Magnitude and Phase. Note that the set version of this command will set the specified marker as the active marker.

Cmd Parameter: `<char> <Style> (GRAPh|LMAGnitude|LOGPhase|and so forth)`

Query Response: `<char> <Style> (GRAP|LMAG|LOGP|and so forth)`

Default Value: GRAP

Example: To set marker #3 readout style to Log Mag:

```
:CALCulate:MARKer3:FORMat LMAG
:CALCulate:MARKer3:FORMat LMAGnitude
:CALC:MARK3:FORM LMAG
```

Related Command: `:CALCulate:MARKer<Mk>:Y?`, `:CALCulate:MARKer:DATA?`

Front Panel Access: **Marker**, Readout Style

:CALCulate:MARKer[1]|2|3|4|5|6|7|8:MAXimum

Description: Puts the specified marker at the maximum value in the trace. Note that this turns on the selected marker (if it is not already on) and sets the selected marker as the active marker.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Related Command: `:CALCulate:MARKer[1]|2|3|4|5|6|7|8:MINimum`

Front Panel Access: **Marker**, Marker Search, Peak Search

:CALCulate:MARKer[1]|2|3|4|5|6|7|8:MINimum

Description: Puts the specified marker at the minimum value in the trace. Note that this turns on the selected marker (if it is not already on) and set the selected marker as the active marker.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Related Command: `:CALCulate:MARKer[1]|2|3|4|5|6|7|8:MAXimum`

Front Panel Access: **Marker**, Marker Search, Valley Search

:CALCulate:MARKer<Mk>:REFerence[:STATe] OFF|ON|0|1
:CALCulate:MARKer<Mk>:REFerence[:STATe]?

Description: Sets the specified marker `<Mk>` as the active marker and turn it on or off. If the value is set to ON or 1, the specified marker is turn on and set as a reference marker. If the value is set to OFF or 0, the specified marker is turn off. The query version of the command returns a 1 if the specified marker is ON and is a reference marker, and returns a 0 if not. `<Mk>` is the marker number in the range of 1 to 8. If no marker number is specified, then the marker number (the `<Mk>` value) defaults to 1.

Syntax:
```
:CALCulate:MARKer<Mk>:REFerence[:STATe] OFF|ON|0|1
:CALCulate:MARKer<Mk>:REFerence[:STATe]?
```

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: OFF

Example: To turn on marker #3 and set it as reference marker:

```
:CALCulate:MARKer3:REFerence ON
:CALCulate:MARKer3:REFerence 1
:CALCulate:MARKer3:REFerence:STATe ON
:CALCulate:MARKer3:REFerence:STATe 1
```

To turn off marker #6:

```
:CALCulate:MARKer6:REFerence OFF
:CALCulate:MARKer6:REFerence:STATe OFF
:CALCulate:MARKer6:REFerence:STATe 0
```

Front Panel Access: **Marker**, Marker Type

:CALCulate:MARKer<Mk>:SOURce <Tr>
:CALCulate:MARKer<Mk>:SOURce?

Description: Sets the specified marker `<Mk>` to the given trace <Tr>. `<Mk>` is the marker number in the range of 1 to 8. If no marker number is specified, then the marker number (the `<Mk>` value) defaults to 1. `<Tr>` is the trace and must be one of the following 9 values:

`TR1|TR2|TR3|TR4|MEM1|MEM2|MEM3|MEM4|ALL`

The query version of the command returns "TR1" if the specified marker is on trace 1, "TR2" if on trace 2, "TR3" if on trace 3, "TR4" if on trace 4, "MEM1" if on trace 1 memory, "MEM2" if on trace 2 memory, "MEM3" if on trace 3 memory, "MEM4" if on trace 4 memory, and "ALL" if the specified marker is on all 4 traces. Note that the set version of this command will set the specified marker as the active marker.

If an error occurs, such as "Marker not ON", the query version of the command returns an error code of `–400`.

Cmd Parameter: `<char> <Tr>`

Query Response: `<char> <Tr>`

Front Panel Access: **Marker**, Marker on Trace

:CALCulate:MARKer[1]|2|3|4|5|6|7|8:TYPE REFerence|DELTa|OFF
:CALCulate:MARKer[1]|2|3|4|5|6|7|8:TYPE?

Description: Sets the specified marker to the given marker type and make it the active marker. If set to REF then the specified marker is turn on and is set as reference marker. If set to DELT then the specified marker is turn on and is set as a delta marker. If set to OFF then the specified marker is turn off. The query version of this command returns the string "REF" if the specified marker is set as reference marker, "DELT" if set as delta marker, or "OFF" if the specified marker is currently set to off.

Cmd Parameter: `<char> REFerence|DELTa|OFF`

Query Response: `<char> REF|DELT|OFF`

Default Value: OFF

Example: To set marker #1 as the reference marker and turn it on:

```
:CALCulate:MARKer1:TYPE REFerence
:CALCulate:MARKer:TYPE REF
```

Front Panel Access: **Marker**, Marker Type

:CALCulate:MARKer[1]|2|3|4|5|6|7|8:X <x-parameter>
:CALCulate:MARKer[1]|2|3|4|5|6|7|8:X?

Description: Sets the location of the marker on the x-axis at the specified location. <x-parameter> is defined in the current x-axis units. The set command will set the specified marker as the active marker. The <x-parameter> given unit must correspond to the specified marker domain type. If no unit is specified with the <x-parameter> then the default unit will be used.

The query version of the command returns the location of the marker on the x-axis followed by the unit. If the Start and Stop values of the domain are the same, then the query returns the X value along with the marker point number within the brackets. The marker point number is determined with the following formula:

$$\text{Marker Point Number} = \frac{\text{No. of Points}}{2} + 1$$

For example, if 201 points are used in the measurement display, then the query returns: `<x-value> (101)`. When the results of division include a fraction, as in the current example, the result is rounded DOWN. `201/2 = 100.5` Rounding down to 100 before adding `1` yields the 101 that is returned by the query.

If an error occurs, such as marker not ON, the query version of the command returns an error code of –400. Note that the marker is snapped to the data point closest to the specified value. The selected marker must be ON for the command to be valid.

Cmd Parameter: `<NRf> <x-parameter> (hertz, meters, feet)`

Query Response: `<NR3> <x-parameter> (hertz, meters, feet)`

Default Units: Hz for frequency domain,
Meters or Feet for distance domain.

Example: To set reference marker #2 (frequency domain) to 5000 hertz on the x-axis:

```
:CALCulate:MARKer2:X 5000
:CALCulate:MARKer2:X 5000Hz
```

To set reference marker #1 to 1.5 GHz on the x-axis:

```
:CALCulate:MARKer1:X 1.5GHz
:CALCulate:MARKer1:X 1.5GHz
```

Related Command: `:CALCulate:MARKer#:DOMain?`
`:CALCulate:MARKer[1]|2|3|4|5|6|7|8:Y?`

Front Panel Access: **Marker**, [Marker 1/2/3/4/5/6/7/8]

:CALCulate:MARKer[1]|2|3|4|5|6|7|8:Y?

Description: Reads the current Y value for the specified marker. The units are in the y-axis unit. The command returns the marker readout style followed by the Y value and unit. If an error occurs, such as marker not ON, the command returns an error code of –400. The selected marker must be ON for the command to be valid.

Table 5-2. Returned Readout Style

Returned Value Symbols	Graph Type
R&I: (real, imaginary)	Real and Imaginary
SWR: magnitude	SWR
LM: magnitude dB	Log Mag
LNM: magnitude dB	Lin Mag
LMP: (magnitude dB, phase deg)	Log Mag & Phase
LNMP: (magnitude dB, phase deg)	Lin Mag and Phase
PH: phase deg	Phase
Z: (real impedance ohm, imaginary impedance ohm)	Impedance
PZ: (magnitude impedance ohm, phase impedance deg)	Polar Impedance
NZ: (real normalized impedance, imaginary normalized impedance)	Normalized Impedance
Y: (real admittance S, imaginary admittance S)	Admittance
NY: (real normalized admittance, imaginary normalized admittance)	Normalized Admittance
GD: group delay unit	Group Delay
LM/2: magnitude dB	LogMag/2

Cmd Parameter: **NA** (query only)

Query Response: `<NR3> (depends on display type)`

Default Units: Current y-axis unit

Related Command: `:CALCulate:MARKer#:DOMain?`
`:CALCulate:MARKer<Mk>:FORMat <Style>`
`:CALCulate:MARKer[1]|2|3|4|5|6|7|8:X?`

Front Panel Access: **NA**

:CALCulate:MATH Subsystem

This subsystem contains functions for controlling math operations on the currently selected measurement and memory.Trace Math Function

:CALCulate:MATH:FUNCtion NORMal|ADD|SUBTract|MULTiply|DIVide
:CALCulate:MATH:FUNCtion?

Description: Sets the math operations on the currently active trace and the trace stored in memory. Note that a trace MUST be stored in Memory. Setting the FUNCtion to NORMal is equivalent of setting the Trace Math to "None" on the front panel. Setting the FUNCtion to ADD is equivalent of setting the Trace Math to "Trace Plus Memory" on the front panel. Setting the FUNCtion to SUBTract is equivalent to setting the Trace Math to "Trace Minus Memory" on the front panel. Setting the FUNCtion to MULTiply is equivalent to setting the Trace Math to "Trace Multiply Memory" on the front panel. Setting the FUNCtion to DIVide is equivalent to setting the Trace Math to "Trace Divide Memory" on the front panel. The query version of the command returns the string "NORM" for no trace math, "ADD" for trace plus memory, "SUBT" for trace minus memory, "MULT" for trace multiply memory, and "DIV" for trace divide memory.

Cmd Parameter: `<char> NORMal|ADD|SUBTract|MULTiply|DIVide`

Query Response: `<char> NORM|ADD|SUBT|MULT|DIV`

Default Value: NORM

Related Command: `:CALCulate:MATH:MEMorize`

Front Panel Access: **Shift 5** (Trace), Trace Math

:CALCulate:MATH:MEMorize

Description: Copies the current measurement trace into memory.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Front Panel Access: **Shift 5** (Trace), Save Trace to Memory

:CALCulate:SMOothing Subsystem

This subsystem contains functions for trace smoothing.

:CALCulate<Tr>:SMOothing:APERture <integer>
:CALCulate<Tr>:SMOothing:APERture?

Description: Sets the smoothing percentage for the given trace <Tr>. The query form of the command returns the current smoothing percentage. <Tr> is the trace number in the range 1 to 4. If no trace number is specified, then the <Tr> parameter defaults to trace number 1. Note that setting the smoothing also sets the given trace as the active trace if it is not already active.

Syntax: `:CALCulate<Tr>:SMOothing:APERture <integer>`
`:CALCulate<Tr>:SMOothing:APERture?`

Cmd Parameter: `<NR1> <integer>`

Query Response: `<NR1> <integer>`

Default Value: 0

Range: 0 to 20

Front Panel Access: **Shift 4** (Measure), Smoothing %

:CALCulate:TRANsform Subsystem

Front panel soft keys that are related to distance measurements, such as the Additional Dist Setup soft key, appear in menus only when the Setup Domain is set up for distance.

:CALCulate:TRANsform:DISTance:MAXimum?

Description: This command returns the maximum distance in millimeters if the current distance unit is set to meter, and otherwise returns the maximum distance in feet. This value is set based on the number of data points, the propagation velocity, and the start and stop frequency.

Cmd Parameter: **NA** (query only)

Query Response: `<NR3> (millimeters or feet)`

Default Value: For 1.6 GHz Model: 18.7429 m
For 6 GHz Model: 4.997 m

Default Unit: millimeters (mm)

Range: –3000.0 m to +3000.0 m

Front Panel Access: **Freq/Dist**, Additional Dist Setup, Distance Info

:CALCulate:TRANsform:DISTance:RESolution?

Description: This command returns the distance resolution in millimeters if the current distance unit is set to meter, and otherwise returns the resolution in feet. This value is set based on the propagation velocity and the start and stop frequencies.

Cmd Parameter: **NA** (query only)

Query Response: `<NR3> (millimeters or feet)`

Default Value: For 1.6 GHz Model: 18.743 cm
For 6 GHz Model: 4.997 cm

Default Unit: millimeters (mm)

Range: –3000.0 m to +3000.0 m

Front Panel Access: **Freq/Dist**, Additional Dist Setup, Distance Info

:CALCulate:TRANsform:DISTance:STARt
:CALCulate:TRANsform:DISTance:STARt?

Description: Sets the start distance for DTF measurements. The query version of this command returns the start distance in millimeters if the current distance unit is set to meter, and otherwise returns the start distance in feet.

Cmd Parameter: `<NRf> (meters or feet)`

Query Response: `<NR3> (millimeters or feet)`

Default Value: 0.0 mm

Default Unit: Meters (m) when setting, Millimeters (mm) for query

Range: –3000.0 m to +3000.0 m

Example: To set the start distance to 5 meters:

```
:CALC:TRAN:DIST:STAR 5
```

To set the start distance to 6 millimeters:

```
:CALCulate:TRANsform:DISTance:STARt 6mm
```

Front Panel Access: **Freq/Dist**, Start Dist

:CALCulate:TRANsform:DISTance:STOP
:CALCulate:TRANsform:DISTance:STOP?

Description: Sets the stop distance for DTF measurements. The query version of this command returns the stop distance in millimeters if the current distance unit is set to meter, and otherwise returns the stop distance in feet.

Cmd Parameter: `<NRf> (meters or feet)`

Query Response: `<NR3> (millimeters or feet)`

Default Value: 6850 mm

Default Unit: Meters (m) when setting, Millimeters (mm) for query

Range: –3000.0 m to +3000.0 m

Front Panel Access: **Freq/Dist**, Stop Dist

:CALCulate:TRANsform:DISTance:UNIT METers|FEET
:CALCulate:TRANsform:DISTance:UNIT?

Description: Sets the units to be used for DTF measurements. The query version of this command returns the string "METER" if the current distance unit is set to meter, and otherwise returns the string "FEET".

Syntax: `:CALCulate:TRANsform:DISTance:UNIT METers|FEET`
`:CALCulate:TRANsform:DISTance:UNIT?`

Cmd Parameter: `<char> METers|FEET`

Query Response: `<char> METER|FEET`

Default Value: METers when setting, METER for query

Example: To set the distance unit to Meter:

```
:CALCulate:TRANsform:DISTance:UNIT METers
:CALC:TRAN:DIST:UNIT MET
```

To set the distance unit to Feet:

```
:CALC:TRAN:DIST:UNIT FEET
:CALCulate:TRANsform:DISTance:UNIT FEET
```

Front Panel Access: **Shift 8** (System), Application Options, Units

:CALCulate<Tr>:TRANsform:DISTance:DATA?

Description: Produces the distance list in meters for the given trace. `<Tr>` is the trace number in the range 1 to 8 (1 to 4 for Traces TR1 to TR4 and 5 to 8 for Memory M1 to M4). If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. The response begins with an ASCII header that specifies the number of data bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. Each distance value is returned in scientific notation and separated by a comma delimiter.

Cmd Parameter: **NA** (query only)

Query Response: `<char> returns block data (meters)`

Default Unit: Meters

Front Panel Access: **NA**

5-3 :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[:WINDow]:TRACe TRACe|MEMory|BOTH
:DISPlay[:WINDow]:TRACe?

Description: Sets the display type for the current active trace. Setting the display type to TRAC will display the trace only. Setting the display type to MEM will display the trace memory only. Setting the display type to BOTH will display both the trace and memory.

Cmd Parameter: `<char> TRACe|MEMory|BOTH`

Query Response: `<char> TRAC|MEM|BOTH`

Default Value: TRAC

Front Panel Access: **Shift 5** (Trace), Display

:DISPlay[:WINDow]:TRACe:FORMat SINGle|DUAL|TRI|QUAD
:DISPlay[:WINDow]:TRACe:FORMat?

Description: Defines the display trace format. The query version of this command returns “SING” if the trace format is set to Single, “DUAL” if set to dual, “TRI” if set to Tri, and “QUAD” if set to Quad.

Syntax:
```
:DISPlay[:WINDow]:TRACe:FORMat SINGle|DUAL|TRI|QUAD
:DISPlay[:WINDow]:TRACe:FORMat?
```

Cmd Parameter: `<char> SINGle|DUAL|TRI|QUAD`

Query Response: `<char> SING|DUAL|TRI|QUAD`

Default Value: QUAD

Example: To set the display trace format to Dual:

```
:DISPlay:TRACe:FORMat DUAL
```

Front Panel Access: **Measure**, Trace Format

:DISPlay:WINDow:TRACe:Y[:SCALe]:GDAPerture <integer>
:DISPlay:WINDow:TRACe:Y[:SCALe]:GDAPerture?

Description: Sets the Group Delay aperture value (which is common to all traces). The query version of this command produces the Group Delay aperture as its output.

Syntax:
```
:DISPlay:WINDow:TRACe:Y[:SCALe]:GDAPerture <integer>
:DISPlay:WINDow:TRACe:Y[:SCALe]:GDAPerture?
```

Cmd Parameter: `<NR1> <integer>`

Query Response: `<NR1> <integer>`

Default Value: 2

Range: 2 to 20

Front Panel Access: **Scale**, Aperture

Note	Graph type must be Group Delay in order to display the Aperture % soft key in the Scale menu.

:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:PDIVision <value>
:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. For Group Delay, sets the scale (time/division) for the y-axis. For Phase, sets the scale (degree/division) for the y-axis. For Log Magnitude and Log Mag/2, sets the scale (dB/division) for the y-axis. For all other measurements, the y-axis is unitless. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameter: `<NRf> <value> (depends on display type)`

Query Response: `<NR3> <value> (depends on display type)`

Default Value: Log Magnitude: 10 dB
Phase: 45°
SWR: 1
Group Delay: 1 ns
Real: 0.2
Imag: 0.2
Log Mag/2: 10 dB
Smith Chart: 10
Log Polar: 10 dB
Linear Polar: 0.2
Real Impedance: 10 ohm
Imaginary Impedance: 10 ohm

Default Unit: Current active value unit (For time, the default for setting is seconds, but the query is always returned in nanoseconds (ns).)

Range: Log Magnitude: 0.05 dB to 40 dB
Phase: 0.1° to 90°
SWR: 0.001 to 10
Group Delay: 1 ps to 260 ns
Real: 0.01 to 260
Imag: 0.01 to 260
Log Mag/2: 0.05 dB to 40 dB
Smith Chart: 1 to 260
Log Polar: 0.05 dB to 40 dB
Linear Polar: 0.001 to 26
Real Impedance: 0.01 ohm to 260 ohm
Imaginary Impedance: 0.01 ohm to 260 ohm

Note	Although these values are not used for Smith Chart, when you query or set through SCPI, the instrument always returns a value. For Smith Chart, use `:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:SMCHart 0|10|20|30|-3`

Front Panel Access: **Scale**, Resolution Per Div

:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:RLEVel <value>
:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameter: `<NR3> <value> (depends on display type)`

Query Response: `<NR3> <value> (depends on display type)`

Default Value: Log Magnitude: 0 dB
SWR: 1
Phase: 0°
Group Delay: 0 ps
Real: 0
Imag: 0
Log Mag/2: 0 dB
Smith Chart: 10
Log Polar: 0 dB
Linear Polar: 1
Real Impedance: 50 ohm
Imaginary Impedance: 0 ohm

Default Unit: Current active value unit (For time, the default for setting is seconds, but the query is always returned in nanoseconds (ns).)

Range: Log Magnitude: –120 dB to +120 dB
SWR: 1 to 10
Phase: –180° to +180°
Group Delay: 0 ps to 260 ns
Real: –10000 to +10000
Imag: –10000 to +10000
Log Mag/2: –120 dB to +120 dB
Smith Chart: 1 to 260
Log Polar: –120 dB to +120 dB
Linear Polar: 0.005 to 130
Real Impedance: –100000 ohm to +1000000 ohm
Imaginary Impedance: –100000 ohm to +1000000 ohm

Note	Although these values are not used for Smith Chart, when you query or set through SCPI, the instrument always returns a value. For Smith Chart, use `:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:SMCHart 0|10|20|30|-3`

Related Command: `:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:RPOSition`

Front Panel Access: **Scale**, Reference Value

:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:RPOSition <integer>
:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:RPOSition?

Description: Sets the reference line scale value for the y-axis.

Cmd Parameter: `<NR1> <integer>`

Query Response: `<NR1> <integer>`

Default Value: Log Magnitude: 9
SWR: 1
Phase: 5
Group Delay: 5
Real: 5
Imag: 5
Log Mag/2: 9
Smith Chart: 10
Real Impedance: 5 ohm
Imaginary Impedance: 5 ohm

Range: Log Magnitude: 0 to 10
SWR: 0 to 10
Phase: 0 to 8
Group Delay: 0 to 10
Real: 0 to 10
Imag: 0 to 10
Log Mag/2: 0 to 10
Smith Chart: 0 to 10
Real Impedance: 0 ohm to 10 ohm
Imaginary Impedance: 0 ohm to 10 ohm

Note	Although these values are not used for Smith Chart, when you query or set through SCPI, the instrument always returns a value. For Smith Chart, use `:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:SMCHart 0|10|20|30|-3`

Related Command: `:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:RLEVel`

Front Panel Access: **Scale**, Reference Line

:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:SMCHart 0|10|20|30|-3
:DISPlay:WINDow:TRACe<Tr>:Y[:SCALe]:SMCHart?

Description: Sets the Smith chart display scale type of the given trace number specified by `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. Setting the value to 0 is equivalent of setting the Smith Chart scale to “Normal” on the front panel. Setting the value to 10 is equivalent of setting the Smith Chart scale to “Expand 10 dB” on the front panel. Setting the value to 20 is equivalent of setting the Smith Chart scale to “Expand 20 dB” on the front panel. Setting the value to 30 is equivalent of setting the Smith Chart scale to “Expand 30 dB” on the front panel. Setting the value to –3 is equivalent of setting the Smith Chart scale to “Compress 3 dB” on the front panel.

Cmd Parameter: `<char> 0|10|20|30|-3`

Query Response: `<char> 0|10|20|30|-3`

Default Value: 0 (Normal)

Front Panel Access: **Scale**

5-4 :Format Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it will be noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Description: This command specifies the format in which data is returned in certain commands. `ASCii` format returns the data in comma-separated ASCII format. The units are the current instrument units. This format requires many more bytes, so it will be the slowest format.

`INTeger,32` values are signed 32-bit integers in little-endian byte order. This format returns the data in 4-byte blocks.

`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 instrument units.

Both `INTeger` and `REAL` formats return a definite block length. Each transfer begins with an ASCII header, such as #42204 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 4).

The remainder of the header indicates the number of bytes that follow the header (in this example, 2204 for INT,32 and REAL,32). You then divide the number of following bytes by the number of bytes in the data format that you have chosen (4 for both INTeger,32 and REAL,32…so 2204/4) to get the number of data points (in this example, 551).

Refer to "Interpreting Returned Data Pair" on page 5-41 for additional information and conversion examples.

Cmd Parameter: `<char> ASCii|INTeger,32|REAL,32`

Query Response: `<char> ASC|INT,32|REAL,32`

Default Value: ASC

Related Command: `:TRACe[:DATA]`

Front Panel Access: **NA**

Interpreting Returned Data Pair

The following section provides two conversion examples on interpreting returned data pairs. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

- For a 551 point trace, the instrument returns 4415 bytes.
  - The first 7 bytes make up the “header” information in ASCI format.
  - The next 4408 bytes make up the actual data (8 bytes x 551 datapoints = 4408 total bytes).
- Each datapoint consists of 8 bytes.
  - The first 4 bytes are the real component
  - The next 4 bytes are the imaginary component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two’s complement format.
- The data is scaled by a factor of 1e6.

Converting INTeger,32 Example:

The instrument returns the following S11 RL data point in INT,32 format:

4d 15 fc ff [real], ef a2 f8 ff [imag]

1. Convert from little endian to big endian:

   ff fc 15 4d [real], ff f8 a2 ef [imag]

2. Since the MSb in both components is 1, they are negative numbers.
3. The binary representation is:

   11111111111111000001010101001101 [real], 11111111111110001010001011101111 [imag]

4. Convert from two’s complement (not the bits and add 1):

   111110101010110011 [real], 1110101110100010001 [imag]

5. Convert the binary values to decimal:

   256691 [real], 482577 [imag]

6. Take out the 1e6 scale factor:

   0.256691 [real], 0.482577 [imag]

7. Finally, convert the values to dB:

   10*log(0.256691^2 + 0.482577^2) = –5.25 dB

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

00 31 2a 47 [real], 00 e8 6a c6 [imag]

1. Convert from little endian to big endian:

   47 2a 31 00 [real], c6 6a e8 00 [imag]

2. The binary representation of the real portion, 47 2a 31 00 is:

   01000111 00101010 01110001 00000000

3. Binary is in IEEE format:
   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   0, the MSb is the sign bit

   10001110, exponent. The actual exponent value is this value minus 127. So, it is 142 – 127 = 15.

   0101010 01110001 00000000 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+1/4+0/8+1/16+0/32+1/64+...) * 2^15 = 43520 (approx.)

5. Repeat steps 2 through 4 for the imaginary portion.

   c6 6a e8 00 in binary is 11000110 01101010 11101000 00000000

   The MSb is the sign bit

   The next 8 bits is the exponent, which is 10001100. The actual value is 140 – 127 = 13

   Converting the remaining bits and multiplying by exponent and accounting for sign, results in –(1+(1/2+1/4+0/8+1/16+0/32+1/64...) * 2^13) = –14976 (approx).

6. Take out the 1e6 scale factor from both parts:

   .043520 [real], –.014976 [imag]

7. Finally, convert the values to dB:

   10*log((.043520)^2 + (-.014976)^2) = –26.7401848 dB

5-5 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to continuous. If the instrument is currently on hold, and if sweep type is set to continuous, then setting to ON restarts the sweep. If the instrument is currently on hold, and if sweep type is set to single, then setting to ON will set the Sweep Type to Continuous and restart the sweep. If the instrument is currently sweeping, then setting a value of OFF or 0 sets the Sweep Type to Single and holds the sweep. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a `1` if the instrument is set to Continuous and Run, or it returns a `0` if set to Hold.

Syntax: `:INITiate:CONTinuous OFF|ON|0|1`
`:INITiate:CONTinuous?`

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: ON or 1 (query returns 1 for ON)

Related Command: `:INITiate:HOLD`

Front Panel Access: **Shift 3 (Sweep)**, Run/Hold

:INITiate:HOLD OFF|ON|0|1
:INITiate:HOLD?

Description: Sets the sweep to hold. If the instrument is currently sweeping, then setting a value of ON or 1 pauses the sweep. If the instrument is currently not sweeping, and if sweep type is set to continuous, then setting a value of OFF or 0, restarts the sweep. If the instrument is currently not sweeping, and if sweep type is set to single, then setting a value of OFF or 0, triggers a sweep. The query version of the command returns a `1` if the hold command is set, and it returns a `0` if a Run is set.

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: OFF or 0 (query returns 0 for OFF)

Related Command: `:INITiate:CONTinuous`

Front Panel Access: **Shift-3 (Sweep)**, Run/Hold

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

If sweep is set to Run, and sweep type is set to Continuous, then sending the `:INIT:IMM` command restarts the sweep.

If sweep is set to Hold, and sweep type is set to Single, then sending the `:INIT:IMM` command starts a sweep (instrument is temporarily in Run). After a single sweep is completed, the instrument returns to Hold.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Related Command: `:STATus:OPERation?`

Front Panel Access: **NA**

5-6 :INPut Subsystem

This subsystem controls characteristics of the input port.

:INPut<port_no>:BIAS:CURRent <current>
:INPut<port_no>:BIAS:CURRent? [0|1]

Description: Sets the internal bias tee current limit for the specified port. When this limit is exceeded, the Bias Tee trips (turns OFF). `<port_no>` is the specified internal bias tee port number 2. The query version of this command returns either the measured internal current or the set internal current limit (both are returned in milliampere units). To return the measured internal current for the specified port number, send the query command either with no value specified after the "?" (default condition) or with a value of `0` specified after the "?". Note that the query result for the measured internal current is valid only if the Bias Tee state is set to internal. If a value of `1` is specified after the "?", then the query version of this command returns the internal current limit that is set for the given port number.

Syntax: `:INPut<port_no>:BIAS:CURRent <current>`
`:INPut<port_no>:BIAS:CURRent? [0|1]`

Cmd Parameter: `<NRf> <current> (milliampere)`

Query Response : `<char> [0|1] (returns value in milliampere)`

Default Value: 450 mA when querying the internal current limit (`:INPut<port_no>:BIAS:CURRent? 1`). The default value for querying the measured current depends upon what is connected to the port.

Default Unit: milliampere (mA)

Range: 0 mA to 450 mA

Front Panel Access: **Shift-3 (Sweep)**, Configure Ports, Bias Tee Setup, Int Current Limit P2

:INPut:BIAS:INTernal:TRIPped[:STATe]?

Description: Returns whether the internal bias tee is tripped. Returns `1` for tripped, otherwise returns `0`.

Cmd Parameter: **NA** (query only)

Query Response : `<boolean> [0|1]`

Front Panel Access: **NA**

:INPut:BIAS:STATe OFF|INTernal
:INPut:BIAS:STATe?

Description: Enables or disables the bias tee. Query returns OFF|INT. For OFF state, query returns OFF (not 0).

Parameter: `OFF|INTernal`

Cmd Parameter: `<char> OFF|INTernal`

Query Response: `<char> OFF|INT`

Default Value: OFF

Front Panel Access: **Shift-3 (Sweep)**, Configure Ports, Bias Tee Setup, Bias Tee

:INPut<port_no>:BIAS:VOLTage <voltage>
:INPut<port_no>:BIAS:VOLTage? [0|1]

Description: Sets the voltage of the internal bias tee for the specified port number. `<port_no>` is the specified internal bias tee port number (currently, only port 2 is supported). The query version of this command returns either the measured internal bias tee voltage or the set internal bias tee voltage (both are returned in Volts). Note that the measured voltage can be slightly different than the set voltage depending on the load conditions. To return the last measured internal bias tee voltage for the specified port number, send the query command either with no value specified after the "?" (default condition) or with a value of 0 specified after the "?". Note that the query result for the measured internal bias tee voltage is valid only if the Bias Tee state is set to internal. If a value of 1 is specified after the "?", then the query version of this command returns the internal bias tee voltage that was set for the given port number.

Cmd Parameter: `<NRf> <12 to 32 Volts>`

Query Response: `<NR3> <Volts>`

Default Value: +12 V when querying the internal bias tee voltage that was set (`:INPut<port_no>:BIAS:VOLTage? 1`). The default value for querying the last measured bias tee voltage may be slightly different depending upon what is connected to the port.

Default Units: Volts

Range: 12 V to 32 V

Front Panel Access: **Shift-3 (Sweep)**, Configure Ports, Bias Tee Setup, Int Voltage P2

5-7 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument setup and data storage.

:MMEMory:LOAD:STATe <integer>, <file name>

Description: Recalls a previously stored setup from the current save location. The saved setup that is to be loaded is specified by `<file name>`. `<file name>` must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must include the extension `".stp"`. The `<integer>` parameter is not currently used, but it must be sent. Send a value of `1`.

Cmd Parameter: `<integer>, <string> (1, file name)`

Query Response: **NA** (no query)

Related Command: `:MMEMory:STORe:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<file name>

Description: Recalls a previously stored measurement trace from the current save location. The saved measurement trace that is to be loaded is specified by `<file name>`. `<file name>` must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must contain a file extension of `".mna"`. Note that the trace that is specified by `<file name>` must be available at the current save location. The `<integer>` parameter is not currently in use, but it must be sent. Send a `1`.

File name extensions:

“.spa” for SPA measurement
“.mna” for VNA and VVM measurements
“.hipm” for HiPM measurements
“.pm” for PM measurements
“.cwsg” for CWSG measurements
“.afp” for AM/FM/PM measurements
“.ia” for Interference Analysis measurements
“.cs” for Channel Scanner measurements
“.wmxd” for WiMAX
“.wmxe” for Mobile WiMAX
“.lte” for LTE measurements
“.p25” for P25 measurements
“.p252” for P25p2 measurements
“.nxdn” for NXDN measurements
“.dpmr” for dPMR measurements
“.dmr2” for DMR 2 measurements
“.ptc” for PTC measurements
“.tetra” for TETRA measurements
“.nbfm” for NBFM measurements

Cmd Parameter: `<integer>, <string> (1, file name)`

Query Response: **NA** (no query)

Example: To recall trace with file name “trace”:

`:MMEMory:LOAD:TRACe 1,"trace.mna"`

Related Command: `:MMEMory:STORe:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7** (File), Recall

:MMEMory:STORe:STATe <integer>, <file name>

Description: Stores the current setup into the file that is specified by `<file name>`. `<file name>` must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must not contain a file extension. The `<integer>` is used to distinguish whether the calibration should be saving with the setup. Send a 1 to save setup without a calibration. Send a 2 to save setup with calibration.

Cmd Parameter: `<integer>, <string> (1|2, filename)`

Query Response: **NA** (no query)

Front Panel Access: **NA**

:MMEMory:STORe:TRACe <integer>, <file name>

Description: Stores the trace into the file that is specified by `<file name>`. `<file name>` must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must not contain a file extension. The `<integer>` parameter is used to distinguish which type of files to save. The following types are available:

<Integer>	Equivalent File type
1	Measurement file (default, if number is not 1 to 6)
2	S2P Real/Imag
3	S2P Lin Mag/Phase
4	S2P Log Mag/Phase
5	Text
6	CSV

Cmd Parameter: `<integer>, <string> (1|2, filename)`

Query Response: **NA** (no query)

Example: To save the trace into the file named “trace”.

`:MMEMory:STORe:TRACe 1,”trace”`

Related Command: `:MMEMory:LOAD:TRACe`

Front Panel Access: **Shift-7** (File), Save
Shift-7 (File), Save Measurement

5-8 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:POWer LOW|HIGH
:SOURce:POWer?

Description: Sets the power levels.

Syntax: `:SOURce:POWer LOW|HIGH`
`:SOURce:POWer?`

Cmd Parameter: `<char> [LOW|HIGH]`

Query Response: `<char> [LOW|HIGH]`

Default Value: HIGH

Range: HIGH: +6 dBm to 0 dBm
LOW: –15 dBm to –25 dBm

Front Panel Access: **Shift-3 (Sweep)**, Configure Ports, Source Power

:SOURce:CORRection:RVELocity Subsystem

Commands in this subsystem deal with the parameters of the physical media of the Device Under Test.

:SOURce:CORRection:RVELocity <number>
:SOURce:CORRection:RVELocity?

Description: Sets the propagation velocity of the cable for DTF measurements.

Cmd Parameter: `<NRf> <number> (unitless)`

Query Response: `<NR3> <number> (unitless)`

Default Value: 1

Range: 0.001 to 1.0

Front Panel Access: **Freq/Dist** (or **Freq**), Domain Setup, Setup Distance, Additional Dist Setup, Propagation Velocity

:SOURce:CORRection:RVELocity:CABLoss <number>
:SOURce:CORRection:RVELocity:CABLoss?

Description: Sets the cable loss for DTF measurements. The query version of this command returns the cable loss in dB/m.

Cmd Parameter: `<NRf> <number> (unitless)`

Query Response: `<NR3> <number> (unitless)`

Default Value: 0.0

Range: 0.0 to 5

Front Panel Access: **Freq/Dist** (or **Freq**), Domain Setup, Setup Distance, Additional Dist Setup, Cable Loss (when DUT Line Type is Coax)

5-9 :SYSTem Subsystem

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

:SYSTem:MBTemperature?

TitleDescription: This command returns the current mother board temperature in degrees Celsius.

Cmd Parameter: **NA** (query only)

Query Response: `<NR3> (degree Celsius)`

Front Panel Access: **NA**

5-10 :Trace Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe[:DATA]? [1]|2|3|4

Description: Transfers the trace data of the given trace from the instrument to the controller.

The format of the block data that is returned can be specified by the command `:FORMat:DATA`. The response begins with an ASCII header that specifies the number of data bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. Each data point is separated by a comma delimiter. Independent of the Graph Type that is associated with the trace, each data point that is transferred by this command consists of complex measurement data (Real and Imaginary values for that point). A 551 point trace therefore has a total of 1102 points that get transferred.

Cmd Parameter: **NA** (query only)

Query Response: `<block> (returns block data)`

Related Command: `:FORMat:DATA;`
`:CALCulate<Tr>:DATA?`

Front Panel Access: **NA**

:TRACe:PREamble? [1]|2|3|4

Description: Returns trace header information for the specified trace. Data can be transferred from the 4 available display traces. Use the commands in the **MMEMory** subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. Refer to the following section, "Example Response Format:".

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as `"NAME=VALUE[UNITS]"`. Note that the parameters that are returned depend on the firmware version and that this document does not cover all parameter values that are returned by the command.

Cmd Parameter: **NA** (query only)

Query Response: `<block> (returns block data)`

Front Panel Access: **NA**

Example Response Format:

#AX is `#40078,` where `A = 4` (the number of digits in number X), and `X = 0078` (the response has 78 characters).

```
#40078SN=6897458,TYPE=DATA,DATE=2009-03-18-03-13-20-00,INT_BIAS_TEE_
CURRENT=0.000000
```

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "NAME=VALUE[UNITS]". For the example response, the serial number (SN) is 6897458 and is returned as `"SN=6897458"`.

Note	The parameters that are returned depend on the firmware version in the S412E, and this document does not cover all possible parameter values that can be returned by the command.

The following 3 tables describe some of the common parameters that can be returned by the `:TRACe:PREamble?` command:

- Table 5-3, "Trace Header Parameters" on page 5-54
- Table 5-4, "Trace Header Marker Parameters" on page 5-62
- Table 5-5, "Trace Header Limits Parameters" on page 5-63

Table 5-3. Trace Header Parameters (Sheet 1 of 8)

Parameter Name	Description
SN	Instrument serial #
UNIT_NAME	Instrument name
TYPE	The data type (Setup or Data)
DATE	Trace date/time
APP_NAME	Application name
APP_VER	Application firmware (FW) version
SUB_MODE	Sub Mode type, where: 0 is for Vector Network Analyzer, 2 is for Vector Voltmeter
S_TYPE	Active trace S type. Current available S Types are: S11 = 0, S21 = 1
TRACE_S_TYPES	S types for all 4 traces. This uses a bit mask, where the bit shift mask is defined as: S_TYPE_BIT_SHIFT 4 S_TYPE_BIT_MASK 0xF For example, to get the S type for trace 1: (int) (sTypes >> (S_TYPE_BIT_SHIFT * 0)) & S_TYPE_BIT_MASK
GRAPH_TYPE	Active Trace graph type. Current available graph types are: Log Mag = 0, SWR = 1, Phase = 2, Real = 3, Imaginary = 4, Group delay = 5, Smith Chart = 6, Log Mag/2 = 7 Linear Polar = 8 Log Polar = 9 Real Impedance = 10 Imaginary Impedance = 11
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF

Table 5-3. Trace Header Parameters (Sheet 2 of 8)

Parameter Name	Description
DOMAIN	Active Trace domain type, where: 0 is frequency domain, 2 is for distance domain
TRACE_DOMAIN_TYPES	Domain types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: DOMAIN_TYPE_BIT_SHIFT 4 DOMAIN_TYPE_BIT_MASK 0xF
DOMAIN_SETUP	Current Domain Setup. Available Domain setups are: Freq = 0, Dist = 2
TRACE_MATH_TYPES	Trace Math types. This uses a bit mask shift, where the bit shift mask is defined as: MATH_TYPE_BIT_SHIFT 4 MATH_TYPE_BIT_MASK 0xF Available math type are: None = 0, Subtract = 1, Add = 2, Multiply = 3, Divide = 4
TRACE_DISPLAY_TYPES	Trace display types. Available trace types are: Trace Only = 0, Memory Only = 1, Trace and Memory = 2
TRACE_MEMORY_STATE	For save/recall purpose. Where 0 is Off and 1 is On.
SMITH_CHART_TYPE	Current active trace Smith Chart type. Available Smith Chart type are: Normal = 0, Expand 10dB = 1, Expand 20dB = 2, Expand 30dB = 3, Compress 3dB = 4
TRACE_SMITH_CHART_TYPES	Smith Chart type. This uses a bit mask shift, where the bit shift mask is defined as: SMITH_CHART_TYPE_BIT_SHIFT 4 SMITH_CHART_TYPE_BIT_MASK 0xF For available types, refer to “SMITH_CHART_TYPE”.
SMITH_REF_IMPED	Reference Impedance. Where: 50 ohm = 0. and 75 ohm = 1
TOTAL_CHANNELS	Trace Format. Available trace format are: Single = 1, Dual = 2, Tri = 3, Quad = 4

Table 5-3. Trace Header Parameters (Sheet 3 of 8)

Parameter Name	Description
ACTIVE_TRACE	Current active trace. Where: 0 is for trace 1, 1 for trace 2, 2 for trace 3, and 3 for trace 4
TOTAL_TRACE	Total number of traces
AVERAGING_COUNT	Current Averaging Count
AVERAGING_FACTOR	Averaging factor
EXTERNAL_REFERENCE	External Reference where 0 is for Off and 1 is for Locked
EXT_REF_FREQ_LIST	Currently not being used.
SWEEP_TYPE	Sweep type. Available sweep types are: Single = 0 and Continuous = 1
EXTERNAL_TRIGGER	Currently not being used.
BIAS_TEE_STATE	Bias Tee State. Currently available Bias Tee states are: Off = 0 and Internal = 2
BIAS_TEE_PORT_SELECTION	Bias Tee port selection. Where: 1 is port 2.
BIAS_TEE_VOLTAGE_Px	Internal Bias Tee voltage, where: x is the port number. Return value is 1000 times the current voltage value in Volts.
INT_BIAS_TEE_VOLTAGE	Internal Bias Tee voltage. Return value in mV. Internal Bias Tee current limit, where: x is the port number. Return value is in mA.
BIAS_TEE_CURRENT_LIMIT_Px	Internal Bias Tee current limit, where: x is the port number. Return value is in mA.
INT_BIAS_TEE_CURRENT	Internal Bias Tee current. Return value is in mA.
RF_SOURCE_POWER	Source Power. Current valid source power: low = 0, and high = 1.
CABLE	The index of the selected cable list, where 0 is the first in the list.
DIST_UNITS	Distance units. Available distance units are: Meter = 0, Feet = 1

Table 5-3. Trace Header Parameters (Sheet 4 of 8)

Parameter Name	Description
IFBW	The index of the selected IFBW list, where 0 is the first in the list.
DUT_LINE_TYPE	DUT Line Type, where Coax = 0.
CUTOFF_FREQ	Currently not used.
PROP_VEL	Propagation Velocity. Value returned is 1000 times the propagation velocity value.
CABLE_LOSS	Cable Loss. Value returned is 1000 times the cable loss value.
MARKER_SELECTED	The current selected marker, where marker # is the value + 1. For example, a value of 0 is marker number 1.
MARKER_TYPE	The current selected marker type. Where: Ref = 0 delta = 1 off = 2
MARKER_TABLE	Currently not being used.
MARKER_READOUT_STYLE	The current selected marker readout style. Available readout styles are: Graph = 0, Log Mag = 1 Log Mag and Phase = 2 Phase = 3 Real and Imaginary = 4 SWR = 5 Impedance = 6 Admittance = 7 Normalized Impedance = 8 Normalized Admittance = 9 Polar Impedance = I0 Group Delay = 11 Log Mag/2 = 12 Lin Mag = 13 Lin Mag and Phase = 14
MARKER_READOUT_FORMAT	Marker Readout Format. Available readout formats are: None = 0 Trace =1 Screen = 2 Table = 3
PORT_x_REF_PLANE_LENGTH	Reference Plane Length, where x is the port number. Returns in units of meter.

Table 5-3. Trace Header Parameters (Sheet 5 of 8)

Parameter Name	Description
TRACE_SMOOTHING_PERCENT	Trace smoothing percent. This uses a bit mask shift, where the bit shift mask is defined as: PERC_SMOOTHING_BIT_SHIFT 8 PERC_SMOOTHING_BIT_MASK 0xFF
SMOOTHING_PERCENT	Current active trace smoothing percent.
CURRENT_LIMIT	The limit type (upper/lower) for the active trace. Upper = 0 and Lower = 1
LIMIT_STATE	The limit state (on/off) for the active trace. On = 0, Off = 1
LIMIT_ALARM	The limit alarm (on/off) for the active trace. On = 0, Off = 1
LIMIT_MESSAGE	Limit Pass Fail Message (on/off) for the active trace. On = 0, Off = 1.
CURRENT_TEMPERATURE	The current temperature. Valid only with a cal. To get the temperature in Celsius divide the result by 4.
TRACE_x_LP_MODE	Currently not used.
TRACE_x_LP_RESPONSE_TYPE	Currently not used.
TRACE_x_LP_PHASOR_IMPULSE	Currently not used.
TRACE_x_POLAR_RESOLUTION	Linear Polar Resolution, where x is the trace number. Returned value is 1000 times the resolution value
TRACE_x_POLAR_REFERENCE	Linear Polar Reference value, where x is the trace number. Returned value is 1000 times the reference value
TRACE_x_POLAR_REFERENCE_LINE	Currently not used
TRACE_x_LOG_POLAR_RESOLUTION	Log Polar Resolution, where x is the trace number. Returned value is in dB.
TRACE_x_LOG_POLAR_REFERENCE	Log Polar Reference value, where x is the trace number. Returned value is in dB.
TRACE_x_LOG_POLAR_REFERENCE_LINE	Currently not used
TRACE_x_REAL_Z_RESOLUTION	Real Impedance resolution, where x is the trace number. Returned value is 1000 times the resolution value.
TRACE_x_REAL_Z_REFERENCE	Real Impedance Reference value, where x is the trace number. Returned value is 1000 times the reference value.
TRACE_x_REAL_Z_REFERENCE_LINE	Real Impedance Reference line, where x is the trace number.

Table 5-3. Trace Header Parameters (Sheet 6 of 8)

Parameter Name	Description
TRACE_x_IMAG_Z_RESOLUTION	Imaginary Impedance resolution, where x is the trace number. Returned value is 1000 times the resolution value.
TRACE_x_IMAG_Z_REFERENCE	Imaginary Impedance Reference value, where x is the trace number. Returned value is 1000 times the reference value.
TRACE_x_IMAG_Z_REFERENCE_LINE	Imaginary Impedance Refernece line, where x is the trace number.
TRACE_x_START_FREQ	Start freq, where x is the trace number. Returns in units of megahertz.
TRACE_x_STOP_FREQ	Stop frequency, where x is the trace number. Returns in units of megahertz.
TRACE_x_CENTER_FREQ	Center frequency, where x is the trace number. Returns in units of megahertz.
TRACE_x_SPAN	Frequency span, where x is the trace number. Returns in units of megahertz.
TRACE_x_START_DIST	Start distance, where x is the trace number. Depending on the given distance unit, value is returned in units of either microfeet or micrometer.
TRACE_x_STOP_DIST	Stop distance, where x is the trace number. Depending on the given distance unit, value is returned in units of either microfeet or micrometer.
TRACE_x_SMOOTHING_PERCENT	Currently not used.
TRACE_x_WINDOWING	Windowing, where x is the trace number. Available windowing settings are: Rectangular = 0, Nominal Side Lobe = 1, Low Side Lobe = 2, Minimum Side Lobe = 3
TRACE_x_GD_APERTURE	Group Delay Aperture, where x is the trace number.
TRACE_x_DSP_DATA_POINTS	Number of data points, where x is the trace number.
TRACE_x_LOG_MAG_RESOLUTION	Log Mag Resolution, where x is the trace number. Returned value is in dB.
TRACE_x_LOG_MAG_REFERENCE	Log Mag Reference value, where x is the trace number. Returned value is in dB.
TRACE_x_LOG_MAG_REFERENCE_LINE	Log Mag Reference Line, where x is the trace number.

Table 5-3. Trace Header Parameters (Sheet 7 of 8)

Parameter Name	Description
TRACE_x_SWR_RESOLUTION	SWR Resolution, where x is the trace number. Returned value is 1000 times the SWR Resolution.
TRACE_x_SWR_REFERENCE	SWR Reference value, where x is the trace number. Returned value is 1000 times the SWR Reference value.
TRACE_x_SWR_REFERENCE_LINE	SWR Reference Line, where x is the trace number.
TRACE_x_PHASE_RESOLUTION	Phase Resolution, where x is the trace number. Returned value is 1000 times the phase resolution.
TRACE_x_PHASE_REFERENCE	Phase Reference value, where x is the trace number. Returned value is 1000 times the phase reference value.
TRACE_x_PHASE_REFERENCE_LINE	Phase Reference Line, where x is the trace number.
TRACE_x_REAL_RESOLUTION	Real Resolution, where x is the trace number. Returned value is 1000 times the resolution per div value.
TRACE_x_REAL_REFERENCE	Real Reference value, where x is the trace number. Returned value is 1000 times the reference value.
TRACE_x_REAL_REFERENCE_LINE	Real Reference line, where x is the trace number.
TRACE_x_IMAG_RESOLUTION	Imaginary Resolution, where x is the trace number. Returned value is 1000 times the reference value.
TRACE_x_IMAG_REFERENCE	Imaginary Reference value, where x is the trace number. Returned value is 1000 times the reference value.
TRACE_x_IMAG_REFERENCE_LINE	Imaginary Reference line, where x is the trace number.
TRACE_x_GD_RESOLUTION	Group Delay Resolution, where x is the trace number. Returns in units of picoseconds.
TRACE_x_GD_REFERENCE	Group Delay Reference value, where x is the trace number. Returns in units of picoseconds.
TRACE_x_GD_REFERENCE_LINE	Group Delay Reference line, where x is the trace number.
TRACE_x_SMITH_SCALE	Currently not used.
TRACE_x_SMITH_IMPEDANCE	Currently not used.
TRACE_x_SMITH_IMPEDANCE_LINE	Currently not used.

Table 5-3. Trace Header Parameters (Sheet 8 of 8)

Parameter Name	Description
TRACE_x_1PCL_RESOLUTION	Log Mag/2 resolution, where x is the trace number. Returned value is in dB.
TRACE_x_1PCL_REFERENCE	Log Mag/2 Reference value, where x is the trace number. Returned value is in dB.
TRACE_x_1PCL_REFERENCE_LINE	Log Mag/2 Reference line, where x is the trace number.
TRACE_x_POLAR_RESOLUTION	Currently not used.
TRACE_x_POLAR_REFERENCE	Currently not used.
TRACE_x_POLAR_REFERENCE_LINE	Currently not used.
CAL_METHOD	Calibration Method, where: SOLT = 0
CAL_TYPE	The index of the selected calibration type list, where 0 is the first in the list.
CAL_LINE_TYPE	Calibration Line Type, where coax = 0.
CAL_PORTx_DUT	The index of the selected Calibration Coax DUT Selector list for port x, where 0 is the first in the list.
CAL_CORRECTION	Calibration correction, where On = 0, and Off = 1
APP_SELF_TEST_MODE	Internal use only
DEBUG_MEAS_GAIN_RANGE	Internal use only
LOG_COUNTER_EVENTS	Internal use only
SWEEP_DEFAULT_FREQS	Internal use only
PWRCAL_RF_SWITCH_FREQ	Internal use only
PWRCAL_LOW_RF_HIGH_TARGET	Internal use only
PWRCAL_LOW_RF_LOW_TARGET	Internal use only
PWRCAL_UPPER_RF_HIGH_TARGET	Internal use only
PWRCAL_UPPER_RF_LOW_TARGET	Internal use only
PWRCAL_UW_RF_HIGH_TARGET	Internal use only
PWRCAL_UW_RF_LOW_TARGET	Internal use only
USER_DEFINED_CAL_KIT_NAME	Internal use only
USER_DEFINED_CAL_KIT	Internal use only
TRACE_LABEL_STATE	Trace label On/Off, where On = 0, Off = 1

Table 5-4. Trace Header Marker Parameters

Markers Parameter Name	Description
MKR_MWVNA_Xx	Marker x X value (where x is the marker number 1 to 8)
MKR_MWVNA_POINTx	Marker x display point
MKR_MWVNA_REALx	Marker x Real value
MKR_MWVNA_IMAGx	Marker x Imaginary value
MKR_MWVNA_READOUTx	Marker x readout style. Available readout styles are: Graph = 0 Log Mag = 1 Log Mag and Phase = 2 Phase = 3 Real and Imaginary = 4 SWR = 5 Impedance = 6 Admittance = 7 Normalized Impedance = 8 Normalized Admittance = 9 Polar Impedance = 10 Group Delay = 11 Log Mag/2 = 12 Lin Mag = 13 Lin Mag and Phase = 14

MKR_MWVNA_FLAGSx	Marker x flags:
	`MWVNA_MARKER_REF_BIT ............ 0x00000001`
	`MWVNA_MARKER_DELTA_BIT .......... 0x00000002`
	`MWVNA_MARKER_ALL_BIT ............ 0x00000004`
	`MWVNA_MARKER_INIT_BIT ........... 0x00000008`
	`MWVNA_MARKER_ZERO_SPAN_BIT ...... 0x00000010`
	`MWVNA_MARKER_OUT_OF_RANGE_BIT ... 0x00000020`

MKR_TRACEx	Specifies to which trace the marker x is attached
MKR_DELTA_TOx	Specifies to which trace the marker x is delta

Table 5-5. Trace Header Limits Parameters

Limits Parameter Name	Description

LIMIT_MWVNA_FLAGS_UPx
LIMIT_MWVNA_FLAGS_LOx
	Upper(UP)/Lower(LO) Limit flags for trace x:
	`LIMIT_LEFT_OF_SCREEN .... 0x00000001`
	`LIMIT_RIGHT_OF_SCREEN ... 0x00000002`
	`LIMIT_IS_ON ............ 0x00000004`
	`LIMIT_IS_RELATIVE ....... 0x00000008`
	`LIMIT_ALARM_IS_ON ....... 0x00000010`
	`LIMIT_LIMIT_UNITIALIZED . 0x00000020`
	`LIMIT_MESSAGE_ON ........ 0x00000040`

LIMIT_MWVNA_POINT_UPx_# LIMIT_MWVNA_POINT_LOx_#	Upper/Lower Limit point value for trace x, where # is the limit point number. Each point value contains the X-axis value, Y-axis value, limit point, and limit flags, separated by a space. **Note:** Limit point and limit flags are not currently used and will always return a value of 0.000000 for limit point and 0 for limit flags.
LIMIT_MWVNA_GRAPH_TYPE_UPx LIMIT_MWVNA_GRAPH_TYPE_LOx	Upper/Lower Limits Graph type. For available graph types, refer to "GRAPH_TYPE" on page 5-54.
LIMIT_MWVNA_TOTAL_POINTS_UPx LIMIT_MWVNA_TOTAL_POINTS_LOx	Upper/Lower Limit total points.

5-11 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not to signal-oriented parameters.

[:SENSe]:RFON[:STATe] ON|OFF|1|0

Description: Sets the state of the RF output signal at the VNA ports to be either ON or OFF when the sweep is set to Hold. When set to ON, the RF signal continues to be energized when the sweep is in hold. When set to OFF, the RF signal is turned off during the hold condition. Note that the sweep may require more time to stabilize when it is set to run, if the RF had been turned OFF during hold.

Cmd Parameter: `<boolean> ON|OFF|1|0`

Query Response: `<bNR1> 1|0`

Default Value: ON

Front Panel Access: **Shift-3 (Sweep)**, RF Pwr in Hold

[:SENSe]:APPLication Subsystem

This subsystem contains application specific commands.

[:SENSe]:APPLication:TST? NORMal|PWRon

Description: Executes an application self test and reports whether any errors were detected. A return value of “0” indicates that the test was completed without detecting any error.

Two self test types can be specified. If no test type is specified, then the test defaults to NORMal. The PWRon self test is a scaled-down version of the normal self test that runs during the instrument power-on cycle.

Syntax: `:APPLication:TST? NORMal|PWRon`

Cmd Parameter: **NA** (query only)

Query Parameter: `<char> NORMal|PWRon`

Query Response: `<NR1> <integer>`

Front Panel Access: **NA**

[:SENSe]:APPLication:TST:RESult?

Description: Returns the application self test result of the previous call to the application self test. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX<block data>,` where `A` is the number of digits in `X,` and `X` is the number of bytes that follow the header. The first information of the <block data> contains the overall self test string (`"PASSED"` or `"FAILED"`) followed by a comma, and each self test result separated by a comma. Each subset of the result is included in angle brackets, `< >`.

Note that an application self test command must be called prior to calling this command in order for the result to be valid.

Cmd Parameter: **NA** (query only)

Query Response: `<block> (No units, NA)`

Front Panel Access: **NA**

[:SENSe]:AVERage Subsystem

This subsystem contains commands that are related to the combination of the data from consecutive sweeps. Use commands in this subsystem to control sweep-to-sweep averaging and max hold functionality.

`[:SENSe]:AVERage:CLEar`

Description: No query. Clears and restarts averaging of the measurement data. Note that sweep averaging count must be set to greater than 1 for averaging to restart.

Cmd Parameter: `<char>`

Query Response: **NA** (no query)

Front Panel Access: **NA**

`[:SENSe]:AVERage:COUNt <integer>`
`[:SENSe]:AVERage:COUNt?`

Description: Sets the number of traces to be averaged. Note that when averaging count is set to be greater than 1, sweep averaging is turned on.
To stop averaging, set the averaging count to 1.

Cmd Parameter: `<NR1> <integer>`

Query Response: `<NR1> <integer>`

Default Value: 1

Range: 1 to 65535

Front Panel Access: **Shift-3 (Sweep)**, Sweep Averaging

[:SENSe]:CALibration Subsystem

This subsystem controls the system calibration.

`[:SENSe]:CALibration:STATe?`

Description: Reports the calibrated state. This command returns a 0 if there is no valid calibration, otherwise it returns the bit of the S parameters that has a valid calibration. The bits are as follows:

S11 bit	0x01
S21 bit	0x04

For example, if a value of 5 is returned, then both of the S parameter bits are valid (since decimal 5 is equivalent to binary 0101).

Cmd Parameter: **NA** (query only)

Query Response: `<NR1> <integer> (0 to 5)`

Front Panel Access: **NA**

[:SENSe]:CORRection Subsystem

This subsystem provides commands for losses or gains external to the instrument.

[:SENSe]:CORRection:DATA? <error terms parameters>

Description: Transfers the system error correction data from the instrument to the controller. `<error term parameter>` are string parameters that describe the different error terms.

<error term parameter>	Description
ERF	(Forward) Reflection tracking
EDF	(Forward) Directivity
ESF	(Forward) Source match
ETF	(Forward) Transmission tracking
ELF	(Forward) Load match
EXF	(Forward) Isolation
ETFS	(Forward Sensitivity) Transmission tracking
ELFS	(Forward Sensitivity) Load match
EXFS	(Forward Sensitivity) Isolation

The format of the block data that is returned can be specified by the command `:FORMat:DATA`. The response begins with an ASCII header that specifies the number of data bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. Each data point is separated by a comma delimiter. Each term contains one complex value (real and imaginary) for each sweep point.

Cmd Parameter: **NA** (query only)

Query Parameter: `<char> <error terms parameters>`

Query Response: `<char> (returns block data)`

Related Command: `:FORMat:DATA`

Front Panel Access: **NA**

[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]:SMCHart 50|75
[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]:SMCHart?

Description: Sets the Smith Chart reference impedance. Sets `50` for 50 ohm. Sets `75` for 75 ohm. The query form of the command returns the current Smith Chart reference impedance in ohms.

Cmd Parameter: `<char> 50|75`

Query Response: `<char> 50|75`

Default Value: 50

Range: 50, 75

Front Panel Access: **Scale**, Reference Impedance

[:SENSe]:CORRection[:STATe] OFF|ON
[:SENSe]:CORRection[:STATe]?

Description: Turns the calibration error correction ON or OFF. Note that error correction can be turned ON only if valid calibration is available.

Parameter: `OFF|ON`

Cmd Parameter: `<boolean> OFF|ON|0|1`

Query Response: `<bNR1> 0|1`

Default Value: 0

Front Panel Access: **Shift-2 (Calibrate)**, Cal Correction

[:SENSe]:CORRection:CKIT Subsystem

This subsystem provides commands that modify and configure the device under test (DUT).

`[:SENSe]:CORRection:CKIT:INFormation? <connector>`

Description: Returns a string of information of the given calibration connector. `<connector>` defines the connector family. Valid connectors for calibration line type COAX are as follows:

`NMALe|NFEMale|KMALe|KFEMale|716Male|716Female|TNCMale|TNCFemale|SMAMale|SMAFemale|USR1|USR2|USR3|USR4`

Note that the connector must be for valid for the current calibration line type.

Note that user 1, 2, 3, or 4 is based on the current calibration method.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX,` where `A` is the number of digits in `X,` and `X` is the number of bytes that follow the header. Parameters are returned in comma-delimited ASCII format. Each parameter is returned as `"NAME=VALUE[UNITS]."`

Cmd Parameter: **NA** (query only)

Query Parameter: `<char> <connector>`

Query Response: `<block> (returns comma-delimitted ASCII format)`

Front Panel Access: **NA**

[:SENSe]:CORRection:CKIT:USER Subsystem

This subsystem contains commands to configure the user device under test (DUT).

[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:C[0]|1|2|3 <capacitance>
[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:C[0]|1|2|3?

Description: Sets the DUT capacitance value for the specified user.

Cmd Parameter: `<NRf> <capacitance> (e-15, e-27, e-36, e-45)`

Query Response: `<NR3> <capacitance> (e-15, e-27, e-36, e-45)`

Example: To set the DUT capacitance #1 for User 1 with line type coax to 5:

`:SENS:CORR:CKIT:USER:COAX:SOLT:C1 5`

Front Panel Access: **NA**

[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:NAME <string>
[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:NAME?

Description: Sets the DUT name for the specified user.

Cmd Parameter: `<string> (no parameter data or units)`

Query Response: `<string> (no parameter data or units)`

Example: To set the DUT name for User 1 with line type coax and calibration method SOLT:

`:SENS:CORR:CKIT:USER:COAX:SOLT:NAME “SOLT1”`

Front Panel Access: **NA**

[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:OPEN <length>
[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:OPEN?

Description: Sets the DUT capacitance value for the specified user.

Cmd Parameter: `<NRf> <length> (millimeters)`

Query Response: `<NR3> <length> (millimeters)`

Example: To set the DUT open offset for User 1 with line type coax to 3 mm:

`:SENS:CORR:CKIT:USER:COAX:SOLT:OPEN 3`

Front Panel Access: **NA**

[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:SHORt <length>
[:SENSe]:CORRection:CKIT:USER[1]|2|3|4:COAX:SOLT:SHORt?

Description: Sets the DUT capacitance value for the specified user.

Cmd Parameter: `<NRf> <length> (millimeters)`

Query Response: `<NR3> <length> (millimeters)`

Example: To set the DUT short offset for User 1 with line type coax to 3 mm:

`:SENSe:CORRection:CKIT:USER:COAX:SOLT:SHORt 3`

Front Panel Access: **NA**

[:SENSe]:CORRection:COLLect Subsystem

This subsystem controls the system calibration. To properly perform a calibration, several parameters must be set. The table below lists all of the required commands. First, use the `:MEDium` and `:CONNector` subcommands to specify the calibration line type and the DUT port setup. Then use the `:METHod` and `:TYPE` subcommands to specify the calibration method and the calibration type. Then use the `:ACQUire` subcommand to specify the calibration components to be measured. Finally, use the `:SAVe` subcommand to calculate, save, and finish the calibration. Note that the calibration components do not need to be measured in any specific order.

[:SENSe]:CORRection:COLLect:ABORt:ALL

Description: Aborts the calibration measurement and restarts the current sweep or measurement, or both.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Front Panel Access: **NA**

[:SENSe]:CORRection:COLLect[:ACQUire] <cal steps>, <port_no>
[:SENSe]:CORRection:COLLect[:ACQUire]?

Description: Performs a measurement of the given steps. `<cal steps>` is the calibration step to be performed and must be one of the following values:

`OPEN|SHORT|LOAD|`
`THRU|ISOLation`

`<port_no>` is the port number, 1. For calibration step `OPEN, SHORT,` and `LOAD,` valid port number is 1. For calibration step `THRU` and `ISOLation,` valid port number is 1 for Fwd.

Note that the calibration step must be valid for the given calibration type and calibration method. Refer to Table 5-6 for a list of valid calibration steps for each type and method.

The query version of this command returns a string that consists of the last calibration step measurement that was performed followed by the port number. The calibration step and port number are delimited by a comma. Note that if no calibration step has been processed, then this command returns the string `"NONE, 0"`.

Cmd Parameter: `<char> <cal steps>, <port_no>`

Query Parameter: `<char> <cal steps>, <port_no>`

Query Response: `<string>`

Front Panel Access: **Shift-2 (Calibrate)**, Start Cal

Calibration Steps and Calibration Types

For each calibration Type, Table 5-6 lists the allowable calibration steps and port_no to be used in command `[:SENSe]:CORRection:COLLect[:ACQUire] <cal steps>, <port_no>`. The calibration steps are different for each calibration Method, and the port_no is different for each calibration Type. For example, for calibration Type RFP1 and calibration Method SOLT, the allowable `<cal steps>, <port_no>` settings are **"OPEN,1"**, "**SHORT,1**", and "**LOAD,1**". The steps that are not allowed are indicated by "—".

Table 5-6. SOLT Calibration Method

Calibration Type	OPEN	SHORT	LOAD	THRU	ISOL
RFP1 (Full S_{11} - Port 1)	1	1	1	—	—
TRFP (Response S_{21} - Trans Response Fwd Path)	—	—	—	1	1
RRP1 (Response S_{11} - Reflection Response Port 1)	1	1	1	—	—
2PFP (1P2P S_{11}, S_{21} - 1 Path 2 Port Fwd Path)	1	1	1	1	1

[:SENSe]:CORRection:COLLect:ACQUire:STATus? [<cal steps>, <port_no>]

Description: This command requests information about the current calibration step or the specified calibration step. If no calibration step is specified, then it returns a 1 if the current calibration step has completed, otherwise it returns a 0. `<cal steps>` is the calibration step to be performed and must be one of the following values:

`OPEN|SHORT|LOAD|THRU|ISOLation`

`<port_no>` is port number 1. For step `OPEN, SHORT,` valid port number is 1. For calibration step `THRU` and `ISOLation,` valid port number is 1 for Fwd.

Cmd Parameter: **NA** (query only)

Query Parameter: `<char> [<cal steps>, <port_no>]`

Query Response: `<NR1> <integer>`

Front Panel Access: **NA**

[:SENSe]:CORRection:COLLect:CONNector<port_no> <connector>
[:SENSe]:CORRection:COLLect:CONNector<port_no>?

Description: Sets the connector family for the given port number. `<port_no>` is port number 1. `<connector>` defines the connector family. Valid connector for calibration line type COAX is the following:

`NMALe|NFEMale|KMALe|KFEMale|716Male|716Female|TNCMale|TNCFemale|SMAMale|SMAFemale|USR1|USR2|USR3|USR4`

Note that the connector must be valid for the current calibration line type.

Cmd Parameter: `<char> <connector>`

Query Response: `<char> <connector> (returns short format only)`

Default Value: KMAL

Front Panel Access: **Shift-2 (Calibrate)**, DUT Port Setup, DUT Port 1

[:SENSe]:CORRection:COLLect:MEDium COAX
[:SENSe]:CORRection:COLLect:MEDium?

Description: Sets the calibration line type.

Cmd Parameter: `<char> COAX`

Query Response: `<char> COAX`

Default Value: COAX

Front Panel Access: **Shift-2** (Calibrate)

[:SENSe]:CORRection:COLLect:METHod SOLT
[:SENSe]:CORRection:COLLect:METHod?

Description: Sets the calibration method.

Parameter: `SOLT`

Cmd Parameter: `<char> SOLT`

Query Response: `<char> SOLT`

Default Value: SOLT

Front Panel Access: **Shift-2** (Calibrate)

[:SENSe]:CORRection:COLLect:SAVe

Description: Calculates the calibration data according to the calibration method that is selected and the steps that are performed and then stores the result. This command is similar to the “calculate and finish” on the front panel of the list of calibration steps.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Front Panel Access: **NA**

[:SENSe]:CORRection:COLLect:STATus?

Description: This command requests information about the calibration status. The command returns `0` if none, `1` if calibration has already started, `2` if calibration has been aborted, `3` if a calibration is currently calculating, and `4` if a calibration has been completed.

Cmd Parameter: **NA** (query only)

Query Response: <char> [<cal steps>, <port_no>]

Front Panel Access: **NA**

[:SENSe]:CORRection:COLLect:STATus:ACCuracy?

Description: This command requests information about the calibration accuracy status. The command returns:

- `0` when no calibration is available (CAL off)
- `1` when the calibration accuracy is high (OK: Accuracy High)
- `2` when the accuracy is moderate due to a change in power level (?P: Accuracy Moderate)
- `3` when the accuracy is moderate due to a change in temperature level by more than 5 deg C (?T: Accuracy Moderate)
- `4` when the accuracy is low due to a change in temperature level by more than 10 deg C (X: Accuracy Low).

Cmd Parameter: **NA** (query only)

Query Response: `<NR1> (integer)`

`0 = CAL off`

`1 = OK: Accuracy High`

`2 = ?P: Accuracy Moderate`

`3 = ?T: Accuracy Moderate`

`4 = X: Accuracy Low`

Front Panel Access: **Shift 2 (Calibrate)**, Existing Cal Info

[:SENSe]:CORRection:COLLect:TYPE <cal type>
[:SENSe]:CORRection:COLLect:TYPE?

Description: Configures the calibration type. `<cal type>` must be one of the following values:

`RFP1|TRFP|RRP1|2PFP`

CAL TYPE	DESCRIPTION
RFP1	Full Port 1
TRFP	Trans Response Fwd Path
RRP1	Reflection Response Port 1
2PFP	1 Path 2 Port Fwd Path

Syntax: `:CORRection:COLLect:TYPE <cal type>`
`:CORRection:COLLect:TYPE?`

Cmd Parameter: `<char> <cal type>`

Query Response: `<char> <cal type>`

Default Value: 2PFP

Front Panel Access: **Shift-2 (Calibrate)**, Cal Type

[:SENSe]:FREQuency Subsystem

Commands in this subsystem pertain to the frequency settings of the instrument.

[:SENSe]:FREQuency:CENTer <freq>
[:SENSe]:FREQuency:CENTer?

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.

Cmd Parameter: `<NRf> <freq> (hertz)`

Query Response: `<NR3> <freq> (hertz)`

Default Value: For 1.6 GHz Model: 800250000 Hz
For 6 GHz Model: 3000250000 Hz

Default Unit: Hz

Range: For 1.6 GHz Model: 500 kHz to 1.6 GHz
For 6 GHz Model: 500 kHz to 6 GHz

Front Panel Access: **Freq/Dist** (or **Freq**), Center Freq

[:SENSe]:FREQuency:SPAN <freq>
[:SENSe]:FREQuency: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 coupled parameters: Start Frequency and Stop Frequency, and may change the Center Frequency.

Cmd Parameter: `<NRf> <freq> (hertz)`

Query Response: `<NR3> <freq> (hertz)`

Default Value: For 1.6 GHz Model: 1599500000 Hz
For 6 GHz Model: 5999500000 Hz

Default Units: Hz

Range: For 1.6 GHz Model: 0 Hz to 1.599500 GHz
For 6 GHz Model: 0 Hz to 5.999500 GHz

Front Panel Access: **Freq/Dist** (or **Freq**), Span

[:SENSe]:FREQuency:DSPAn?

Description: This command returns the suggested frequency span based on the start and stop distance.

Syntax: `:FREQuency:DSPAn?`

Cmd Parameter: **NA** (query only)

Query Response: `<NR3> <freq> (hertz)`

Default Value: For 1.6 GHz Model: At preset, DSpan is 799750000 Hz
For 6 GHz Model: At preset, DSan is 2999750000 Hz

Default Units: Hz

Range: For 1.6 GHz Model: 0 Hz to 799750000 Hz
For 6 GHz Model: 0 Hz to 2.999750000 GHz

Front Panel Access: **Freq/Dist**, Additional Dist Setup, Distance Info

[:SENSe]:FREQuency:STARt <freq>
[:SENSe]:FREQuency:STARt?

Description: Sets the start frequency. Note that changing the value of the start frequency will also change the value of coupled parameters: `Center Frequency` and `Span.`

Syntax: `:FREQuency:STARt <freq>`
`:FREQuency:STARt?`

Cmd Parameter: `<NRf> <freq> (hertz)`

Query Response: `<NR3> <freq> (hertz)`

Default Value: 500000 Hz

Default Units: Hz

Range: For 1.6 GHz Model: 500 kHz to 1.6 GHz
For 6 GHz Model: 500 kHz to 6 GHz

Example: Sets the start frequency to 10000 HZ:

```
:SENSe:FREQuency:STARt 10000
```

Sets the start frequency to 5 MHz:

```
:SENSe:FREQuency:STARt 5MHZ
```

Sets the start frequency to 1 GHz:

```
:SENS:FREQ:STAR 1GHZ
```

Front Panel Access: **Freq/Dist** (or **Freq**), Start Freq

[:SENSe]:FREQuency:STOP

Description: Sets the stop frequency. Note that changing the value of the stop frequency will change the value of coupled parameters: `Center Frequency` and `Span`.

Syntax: `:FREQuency:STOP <freq>`
`:FREQuency:STOP?`

Cmd Parameter: `<NRf> <freq> (hertz)`

Query Response: `<NR3> <freq> (hertz)`

Default Value: For 1.6 GHz Model: 1600000000 Hz
For 6 GHz Model: 6000000000 Hz

Default Units: Hz

Range: For 1.6 GHz Model: 500 kHz to 1.6 GHz
For 6 GHz Model: 500 kHz to 6 GHz

Example: Sets the stop frequency to 10000 Hz:

`:SENSe:FREQuency:STOP 10000`

Sets the stop frequency to 5 MHz:

`:SENSe:FREQuency:STOP 5MHZ`

Sets the stop frequency to 1 GHz:

`:SENS:FREQ:STOP 1GHZ`

Front Panel Access: **Freq/Dist** (or **Freq**), Stop Freq

:SENSe<Tr>:FREQuency:DATA?

Description: Produces the frequency list in Hz for the given trace. `<Tr>` is the trace number in the range 1 to 8 (1 to 4 for Traces TR1 to TR4 and 5 to 8 for Memory M1 to M4). If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. The response begins with an ASCII header that specifies the number of data bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. Each frequency point is in scientific notation and separated by a comma delimiter.

Cmd Parameter: **NA** (query only)

Query Response: `<char> <freq> (returns block data in hertz)`

Default Units: Hz

Related Command: `:CALCulate<Tr>:TRANsform:DISTance:DATA?`

Front Panel Access: **NA**

[:SENSe]:SWEep Subsystem

This subsystem includes commands that affect the sweep parameters of the instrument.

`[:SENSe]:SWEep:IFBW <freq value>`
`[:SENSe]:SWEep:IFBW?`

Description: Sets the IF Bandwidth. The `<freq value>` in Hz must be one of the following 13 values:

`100000|50000|20000|10000|5000|2000|1000|500|200|100|50|20|10`

The query form of this command returns the frequency in Hz.

Cmd Parameter: `<char> <freq value>`

Query Response: `<char> <freq value>`

Default Value: 10000

Default Units: Hz

Range: 10 to 100000 Hz

Example: Sets the IF Bandwidth frequency to 200 Hz:

`:SENS:SWE:IFBW 200`

Sets the IF Bandwidth frequency to 100 kHz:

`:SENS:SWE:IFBW 100000`

Front Panel Access: **Shift-3 (Sweep)**, IFBW

`[:SENSe]:SWEep:POINts <integer>`
`[:SENSe]:SWEep:POINts?`

Description: Sets the total number of measurement points per sweep. Note that a sweep with a lower number of data points will complete in less time than a sweep with a higher number of data points.

Syntax: `:SWEep:POINts <integer>`
`:SWEep:POINts?`

Cmd Parameter: `<NR1> <integer>`

Query Response: `<NR1> <integer>`

Default Value: 201

Range: 2 to 4001

Front Panel Access: **Shift-3 (Sweep)**, Data Points

[:SENSe]:SWEep:TYPE SINGle|CONTinuous
[:SENSe]:SWEep:TYPE?

Description: Sets the sweep type. The query version of this command returns "SING" if current sweep is set to single sweep, and returns "CONT" if set to continuous sweep. Note that setting the sweep type to SINGle sets the sweep to hold.

Cmd Parameter: <char> SINGle|CONTinuous

Query Response: <char> SING|CONT

Default Value: CONT

Front Panel Access: **Shift-3 (Sweep)**, Sweep Type

[:SENSe]:TRACe Subsystem

This subsystem includes commands that provide general settings for each trace.

[:SENSe]:TRACe<Tr>:DOMain FREQuency|DISTance
[:SENSe]:TRACe<Tr>:DOMain?

Description: Defines the domain for the given trace <Tr>. <Tr> is the trace number in the range 1 to 4. If no trace number is specified, then the <Tr> parameter defaults to trace number 1. The query version of this command returns "FREQ" if domain is Frequency, and "DIST" if domain is distance.

Syntax: :TRACe<Tr>:DOMain FREQuency|DISTance
:TRACe<Tr>:DOMain?

Cmd Parameter: <char> FREQuency|DISTance

Query Response: <char> FREQ|DIST

Default Value: Trace 1: FREQ
Trace 2: FREQ
Trace 3: FREQ
Trace 4: FREQ

Front Panel Access: **Measure**, Domain Selection

[:SENSe]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. Note that this may also change the total number of traces.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Default Value: TR1

Example: To set trace 2 as the active trace:

```
:SENSe:TRACe2:SELect
:SENS:TRAC2:SEL
```

To set trace 1 as the active trace:

```
:SENSe:TRACe1:SELect
:SENSe:TRACe:SELect
```

Front Panel Access: **Measure**, Active Trace

[:SENSe]:TRACe<Tr>:SPARams S11|S21
[:SENSe]:TRACe<Tr>:SPARams?

Description: Defines the S-parameter for the given trace, `<Tr>`.

`<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. The query version of this command returns "S11" if the S-parameter is set to S11, "S21" if set to S21.

Syntax:

```
:TRACe<Tr>:SPARams S11|S21
:TRACe<Tr>:SPARams?
```

Cmd Parameter: `<char> [S11|S21`

Query Response: `<char> [S11|S21`

Default Value: Trace 1: S11
Trace 2: S21
Trace 3: S11
Trace 4: S21

Example: To assign S11 to trace 2:

```
:SENSe:TRACe2:SPARams S11
```

Front Panel Access: **Measure**, S Parameter

[:SENSe]:TRACe:TOTal <integer>
[:SENSe]:TRACe:TOTal?

Description: Sets the number of traces to display.

Cmd Parameter: `<char> [1|2|3|4]`

Query Response: `<char> [1|2|3|4]`

Default Value: 2

Range: 1 to 4

Example: To set number of traces to 3:

`:SENSe:TRACe:TOTal 3`

Front Panel Access: **Measure**, Number of Traces

[:SENSe]:TRACe:SELect?

Description: This command returns the current active trace number in the format `TR#.`

Cmd Parameter: **NA** (query only)

Query Response: `<char> [TR1|TR2|TR3|TR4]`

Example: To query for the active trace number:

`:SENS:TRAC:SEL?`

Front Panel Access:**Measure**, Active Trace

Chapter 6 — Vector Voltmeter Commands

6-1 Introduction

This chapter describes commands for Vector Voltmeter mode. Only the commands that are listed in this chapter and in Chapter 3, "All Mode Commands" can be used in Vector Voltmeter mode. Using commands from other modes may produce unexpected results.

Refer to Chapter 5 for additional information on the following commands.

[:SENSe]:CALibration	on page 5-66
[:SENSe]:CORRection	on page 5-67
[:SENSe]:CORRection:CKIT	on page 5-69
[:SENSe]:CORRection:CKIT:USER	on page 5-70
[:SENSe]:CORRection:COLLect	on page 5-71

6-2 :FETCh Subsystem

This subsystem contains commands to fetch the VVM data and relative data.

:FETCh:VVM:DATA?

Description: Query only. Returns the most recent VVM measurement results. Data is returned as 2 or 4 comma-separated values depending upon the measurement type, measurement format, measurement mode, port, and the reference setting. A "–" is returned for any data that is not valid at that instance.

Table 6-1. VVM Measurement Results

If	Then	Data Values
If the measurement type is Insertion, and if the measurement mode is CW,	then data is returned as 4 comma-separated values	Amplitude Phase Reference Amplitude Reference Phase.
If the measurement type is Insertion, and if the measurement mode is CW with save new reference set,	then data is returned as 4 comma-separated values	Relative Amplitude Relative Phase Reference Amplitude Reference Phase.
If the measurement type is Return, and if the measurement mode is CW, and if format is set to dB,	then data is returned as 4 comma-delimited values	Amplitude Phase Reference Amplitude Reference Phase.
If the measurement type is Return, and if the measurement mode is CW with save new reference set, and if format is set to dB,	then data is returned as 4 comma-delimited values	Relative Amplitude Relative Phase Reference Amplitude Reference Phase.
If the measurement type is Return, and if format is set to VSWR,	then data is returned as 2 comma-delimited values	VSWR Reference VSWR.
If the measurement type is Return, and if the measurement mode is CW with save new reference set, and if format is set to VSWR,	then data is returned as 2 comma-delimited values	Relative VSWR Reference VSWR.
If the measurement type is Return, and if the measurement mode is CW, and if format is set to Impedance,	then data is returned as 4 comma-delimited values	Real Imaginary Reference Real Reference Imaginary.
If the measurement type is Return, and if the measurement mode is CW with save new reference set, and if format is set to Impedance,	then data is returned as 4 comma-delimited values	Relative Real Relative Imaginary Reference Real Reference Imaginary.
If the measurement mode is Table with save new reference set,	then data is returned as 4 comma-separated values	Amplitude Phase Relative Amplitude Relative Phase.

Cmd Parameter: **NA** (query only)

Query Response: **NA** (comma separated values)

Example: To fetch the VVM data:

:FETCh:VVM:DATA?

Front Panel Access: **NA**

:FETCh:VVM:REFerence:DATA?

Description: Returns the reference data depending upon the measurement type, the measurement format, and the current port.

Syntax: :FETCh:VVM:REFerence:DATA?

Cmd Parameter: **NA** (query only)

Query Response: **NA** (comma separated values)

Example: To fetch the VVM reference data:

:FETCh:VVM:REFerence:DATA?

Front Panel Access: **NA**

6-3 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument setup and data storage.

:MMEMory:LOAD:STATe <integer>, <file name>

Description: Recalls a previously stored setup from the current save location. The saved setup that is to be loaded is specified by <file name>. <file name> must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must include the extension ".stp". The <integer> parameter is not currently used, but it must be sent. Send a value of 1.

Cmd Parameter: <integer>, <string> (1, file name)

Query Response: **NA** (no query)

Related Command: :MMEMory:STORe:STATe
:MMEMory:MSIS INTernal|USB

Front Panel Access: **Shift-7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<file name>

Description: Recalls a previously stored measurement trace from the current save location. The saved measurement trace that is to be loaded is specified by `<file name>`. `<file name>` must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must contain a file extension of `".mna"`. Note that the trace that is specified by `<file name>` must be available at the current save location. The `<integer>` parameter is not currently in use, but it must be sent. Send a `1`.

File name extensions:

“.spa” for SPA measurement
“.mna” for VNA and VVM measurements
“.hipm” for HiPM measurements
“.pm” for PM measurements
“.cwsg” for CWSG measurements
“.afp” for AM/FM/PM measurements
“.ia” for Interference Analysis measurements
“.cs” for Channel Scanner measurements
“.wmxd” for WiMAX
“.wmxe” for Mobile WiMAX
“.lte” for LTE measurements
“.p25” for P25 measurements
“.p252” for P25p2 measurements
“.nxdn” for NXDN measurements
“.dpmr” for dPMR measurements
“.dmr2” for DMR 2 measurements
“.ptc” for PTC measurements
“.tetra” for TETRA measurements
“.nbfm” for NBFM measurements

Syntax: `:MMEMory:LOAD:TRACe <integer>,<file name>`

Cmd Parameter: `<integer>, <string> (1,file name)`

Query Response: **NA** (no query)

Example: To recall trace with file name “trace”:

`:MMEMory:LOAD:TRACe 1,"trace.mna"`

Related Command: `:MMEMory:STORe:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7** (File), Recall

:MMEMory:STORe:STATe <integer>, <file name>

Description: Stores the current setup into the file that is specified by `<file name>`. `<file name>` must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must not contain a file extension. The `<integer>` is used to distinguish whether the calibration should be saving with the setup. Send a 1 to save setup without a calibration. Send a 2 to save setup with calibration.

Syntax: `:MMEMory:STORe:STATe <integer>, <file name>`

Cmd Parameter: `<integer>, <string> (1|2, filename)`

Query Response: **NA** (no query)

Front Panel Access: **NA**

:MMEMory:STORe:TRACe <integer>, <file name>

Description: Stores the trace into the file that is specified by `<file name>`. `<file name>` must be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and must not contain a file extension. The `<integer>` parameter is used to distinguish which type of files to save. The following types are available:

<Integer>	File type
1	Measurement file (default, if number is not 1 to 6)
2	S2P Real/Imag
3	S2P Lin Mag/Phase
4	S2P Log Mag/Phase
5	Text
6	CSV

Cmd Parameter: `<integer>, <string> (1|2, filename)`

Query Response: **NA** (no query)

Example: To save the trace into the file named “trace”.

`:MMEMory:STORe:TRACe 1,”trace”`

Related Command: `:MMEMory:LOAD:TRACe`

Front Panel Access: **Shift-7** (File), Save
Shift-7 (File), Save Measurement

6-4 :TRACe Subsystem

This subsystem contains commands pertaining to the Vector Voltmeter mode.

:TRACe:PREamble?

Description: Query only. Returns trace header information. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX,` where `A` is the number of digits in `X,` and `X` is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as `"NAME=VALUE[UNITS]"`. Note that the parameters that are returned depend on the firmware version and that this document does not cover all parameter values that are returned by the command. Refer to Table 6-2, "Trace Header Parameters.

For the example response, the serial number (SN) is 83320012 and is returned as "SN=83320012".

Query Response: `<char> (returns block data)`

Front Panel Access: **NA**

Example Response Format:

[#800001070SN=83320012,UNIT_NAME=,TYPE=DATA,DATE=1999-11-30-02-00-10-10, APP_NAME=MWVNA,APP_VER=T0.00.1001,VVM_MODE=0.000000,VVM_CW_FREQ= 0.005000,VVM_MEAS_TYPE=0.000000,VVM_RETURN_MEAS_FORMAT=0.000000, VVM_CABLE=1.000000,VVM_PORT_1_SAVE_RETURN_REF=0.000000,VVM_PORT_1_ SAVE_INSERTION_REF=0.000000,VVM_PORT_2_SAVE_RETURN_REF=0.000000,VVM_ PORT_2_SAVE_INSERTION_REF=0.000000,VVM_PORT_1_RETURN_REF_AMP= 0.000000,VVM_PORT_1_RETURN_REF_PHASE=0.000000,VVM_PORT_1_RETURN_REF_ VSWR=1000.000000,VVM_PORT_1_RETURN_REF_REAL=0.000000,VVM_PORT_1_ RETURN_REF_IMAG=0.000000,VVM_PORT_1_INSERTION_REF_AMP=0.000000,VVM_ PORT_1_INSERTION_REF_PHASE=0.000000,VVM_PORT_1_RETURN_REF_RAW_ REAL=1000000.000000,VVM_PORT_1_RETURN_REF_RAW_IMAG=0.000000,VVM_PORT _2_RETURN_REF_AMP=0.000000,VVM_PORT_2_RETURN_REF_PHASE=0.000000,VVM_ PORT_2_RETURN_REF_VSWR=1000.000000,VVM_PORT_2_RETURN_REF_REAL= 0.000000,VVM_PORT_2_RETURN_REF_IMAG=0.000000,VVM_PORT_2_INSERTION_ REF_AMP=0.000000,VVM_PORT_2_INSERTION_REF_PHASE=0.000000,VVM_PORT_2_ RETURN_REF_RAW_REAL=1000000.000000,
VVM_PORT_2_RETURN_REF_RAW_IMAG=0.000000, CAL_PORT=1]

Trace Header Parameters

Table 6-2 describes parameters that can be returned by the `:TRACe:PREamble?` command.

Table 6-2. Trace Header Parameters

Parameter Name	Description
SN	Instrument Serial #
UNIT_NAME	Instrument name
DATE	Trace date/time
APP_NAME	Application name
APP_VER	Application firmware (FW) version

VVM_MODE	Mode
	`0 = CW`
	`1 = Table`

VVM_CW_FREQ	CW frequency

VVM_MEAS_TYPE	Measurement type.
	`0 = Return`
	`1 = Insertion`

VVM_RETURN_MEAS_FORMAT	Return Type Measurement Format
	`0 = dB`
	`1 = VSWR`
	`2 = Impedance`

VVM_CABLE	Selected Cable number 1 to 12
VVM_PORT_X_SAVE_RETURN_REF	Saved status for Port x Return reference, where x = 1 or 2
VVM_PORT_X_SAVE_INSERTION_REF	Saved status for Port x Insertion reference, where x = 1 or 2
VVM_PORT_X_RETURN_REF_AMP	Return reference amplitude for Port x, where x = 1 or 2
VVM_PORT_X_RETURN_REF_PHASE	Return reference phase for Port x, where x = 1 or 2
VVM_PORT_X_RETURN_REF_VSWR	Return reference VSWR for Port x, where x = 1 or 2
VVM_PORT_X_RETURN_REF_REAL	Return reference real for Port x, where x = 1 or 2
VVM_PORT_X_RETURN_REF_IMAG	Return reference imaginary for Port x, where x = 1 or 2
VVM_PORT_X_INSERTION_REF_AMP	Insertion reference amplitude for Port x, where x = 1 or 2
VVM_PORT_X_INSERTION_REF_PHASE	Insertion reference phase for Port x, where x = 1 or 2

6-5 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not to signal-oriented parameters.

`[:SENSe]:VVM:CABLe:SELect 1|2|3|4|5|6|7|8|9|10|11|12`
`[:SENSe]:VVM:CABLe:SELect?`

Description: Selects the VVM cable. The query format of the command returns the current VVM cable number.

Cmd Parameter: `<char> 1|2|3|4|5|6|7|8|9|10|11|12`

Query Response: `<char> 1|2|3|4|5|6|7|8|9|10|11|12`

Default Value: 1

Example: To set the Cable to 6:

`:SENSe:VVM:CABLe:SELect 6`

Front Panel Access: **Table**, Select Cable

`[:SENSe]:VVM:FORMat DB|VSWR|IMPedance`
`[:SENSe]:VVM:FORMat?`

Description: Sets the VVM Return type measurement format. The query format of the command returns the VVM Return type measurement format.

Cmd Parameter: `<char> DB|VSWR|IMPedance`

Query Response: `<char> DB|VSWR|IMP`

Default Value: DB

Example: To set the type to VSWR:

`:SENSe:VVM:FORMat VSWR`

Front Panel Access: **CW**, Return Meas Format

`[:SENSe]:VVM:FREQuency:CW <freq>`
`[:SENSe]:VVM:FREQuency:CW?`

Description: Sets the VVM CW frequency. The query format of the command returns the CW frequency.

Cmd Parameter: `<NRf> <freq> (hertz)`

Query Response: `<NR3> <freq> (hertz)`

Default Value: 500 kHz

Default Units: Hz

Range: 500 kHz to Unit Maximum Frequency

Front Panel Access: **CW/Table**, CW Frequency

[:SENSe]:VVM:MODE CW|TABLe
[:SENSe]:VVM:MODE?

Description: Sets the VVM measurement mode. The query format of the command returns the VVM measurement mode.

Cmd Parameter: `<char> CW|TABLe`

Query Response: `<char> CW|TABL`

Default Value: CW

Example: To set the mode to Table:

`:SENSe:VVM:MODE TABLe`

Front Panel Access: CW: **Hard Key 1**

TABLe: **Hard Key 2**

[:SENSe]:VVM:REFerence:CLEar

Description: Clears the reference data for the current port and measurement type.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Default Value: No Reference

Example: To clear the Reference:

`:SENSe:VVM:REFerence:CLEar`

Front Panel Access: **CW/Table**, Clear Reference

[:SENSe]:VVM:REFerence:MEMorize

Description: Sets the reference data for the current port and measurement type.

Cmd Parameter: **NA**

Query Response: **NA** (no query)

Default Value: No Reference

Example: To set the new Reference:

`:SENSe:VVM:REFerence:MEMorize`

Front Panel Access: **CW/Table**, Save New Reference

[:SENSe]:VVM:TYPE RETurn|INSertion
[:SENSe]:VVM:TYPE?

Description: Sets the VVM measurement type. The query format of the command returns the VVM measurement type.

Parameter: `RETurn|INSertion`

Cmd Parameter: `<char> RETurn|INSertion`

Query Response: `<char> RET|INS`

Default Value: RET

Example: To set the type to Insertion:

`:SENSe:VVM:TYPE INSertion`

Front Panel Access: **CW/Table**, Measurement Type

Chapter 7 — Fixed WiMAX Commands

7-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Title: Abort

Description: Restarts the current sweep and/or measurement. Resets the trigger system. 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.

Parameter: NA

Related Command: `:INITiate:CONTinuous`
`:INITiate[:IMMediate]`

7-2 :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 SUMMary

Title: Configure Summary Measurement

Description: This command configures the summary of all the related numerical measurement results. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe] commands before initiating a measurement.

Parameter: `SUMMary`

Parameter Type: <char>

Front Panel Access: **Shift-4 (Measure)**, WiMAX Summary

:CONFigure:DEMod <char>

Title: Configure Demodulation Measurement

Required Option: 47

Description: Valid <char> parameters are:
SUMMary | CONStln | SFLatness | EVSCarrier | EVSYmbol.

This command configures the selected demodulation measurement. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe]:DEMod commands before initiating a measurement.

When the SUMMARY option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator, then Modulation Summary from the front panel. When the CONStln option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator, then Constellation from the front panel. When the SFLatness option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator, then Spectral Flatness from the front panel. When the EVSCarrier option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator then EVM vs Sub Carrier from the front panel. When the EVSYmbol option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator then EVM vs Symbol from the front panel.

Parameter: `<char>`

Front Panel Access: **Shift-4 (Measure)**, Demodulator

:CONFigure PFail

Title: Configure PASS/FAIL Measurement

Description: This command configures the PASS/FAIL measurement. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe] commands before initiating a measurement. The measurement results are equivalent to the results that are displayed by choosing Measurements, then PASS/FAIL from the front panel.

Parameter: `PFail`

Related Command: `:FETCh:PFail?`
`MEASure:PFail?`
`READ:PFail?`

Front Panel Access: **Shift-4 (Measure)**, Pass/Fail Mode

:CONFigure:RF <char>

Title: Configure RF Measurement

Required Option: 46

Description: Valid parameter options: SUMMary | SPECtrum | PVTime | ACPR

This command configures the selected RF measurement. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe]:RF commands before initiating a measurement.

When the SUMMary option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then RF Summary from the front panel. When the SPECtrum option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then Spectrum from the front panel. When the PVTime option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then Power vs Time from the front panel. When the ACPR option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then ACPR from the front panel.

Parameter: `<char>`

Related Command: `:FREQuency`

7-3 :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:WINDow:TRACe:MAXHold OFF|ON|0|1
:DISPlay:WINDow:TRACe:MAXHold?

Title: Max Hold State

Description: Specifies whether the Max Hold is ON or OFF. The default value is 0. That is, sending :DISP:WIND:TRAC:MAXH is equivalent to sending :DISP:WIND:TRAC:MAXH ON. The query version of the command returns a 1 if Max Hold is set to ON and returns a 0 if the Max Hold is set to OFF. Note that this command is available only in the Spectrum and EVM vs. Sub-carrier views.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: 0

Related Command: `:CONFigure:RF SPECtrum`
`:CONFigure:DEMod EVSCarrier`

Front Panel Access: **Shift-5 (Trace)**, Max Hold

:DISPlay:WINDow:TRACe:Y[:SCALe]:OFFSet <rel ampl>
:DISPlay:WINDow:TRACe:Y[:SCALe]:OFFSet?

Title: Power Offset

Description: Sets the power offset value for the y-axis.

Parameter: `<rel ampl>`

Default Value: 0 dB

Default Unit: dB

Range: 0 dB to 100 dB

Front Panel Access: **Amplitude**, Power Offset

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Title: Scale Resolution Per Division

Description: Sets the scale per division for the y-axis. The units change from dB/div to % when EVM is the y-axis value. The resolution per division value is maintained separately for each measurement.

Parameter: `<value>`

Default Value: Spectral Flatness: 1 dB/div
EVM vs. SubCarrier: 0.50%
EVM vs. Symbol: 0.50%
All others: 10dB/div

Default Unit: Current active amplitude unit

Range: EVM vs. SubCarrier: 0.1 % to 10 %
EVM vs. SubCarrier: 0.1 % to 10 %
All others: 1 dB to 15 dB

:DISPlay:WINDow:TRACe:Y[:SCALe]:TOP <amplitude>
:DISPlay:WINDow:TRACe:Y[:SCALe]:TOP?

Title: Y Axis Max

Description: Sets the maximum value of the Y axis. Note that this command is available only in the Spectral Flatness and EVM vs. Symbol/Sub-carrier views.

Parameter: `<amplitude>`

Default Value: Spectral Flatness: 5dB
EVM vs. Symbol: 5%
EVM vs. Sub-carrier: 5%

Default Unit: Current active amplitude unit

Range: Spectral Flatness: –5 to 5
EVM vs. Symbol: 1% to 100%
EVM vs. Sub-carrier: 1% to 100%

Front Panel Access: **Amplitude**, Y Axis Max

7-4 :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:DEMod:CONStln?

Title: Fetch Constellation

Description: Returns the constellation of the demodulated data symbol over one frame measurement results.

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID. "--" is returned for each data that is not valid at that instance.

:FETCh:DEMod:EVSCarrier?

Title: Fetch EVM vs. Sub Carrier

Description: Returns the EVM vs. Sub Carrier measurement results.

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID. "--" is returned for each data that is not valid at that instance.

:FETCh:DEMod:EVSYmbol?

Title: Fetch EVM vs. Symbol

Description: Returns the EVM vs. Symbol measurement results.

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID. "--" is returned for each data that is not valid at that instance.

:FETCh:DEMod:SFLatness?

Title: Fetch Spectral Flatness

Description: Returns the absolute delta of the power between adjacent sub carriers in dB. "--" is returned for data that is not valid at that instance.

:FETCh:PFail?

Title: Fetch PASS/FAIL

Description: Returns the most recent PASS/FAIL measurement results. Measurement results are returned in a block of ASCII text in the format of <header><block>. The ASCII 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 block consists of a set of records which indicate individual test results. Records are comma-separated. Each record follows the format <test ID>: <input1> <input2> <min> <max> <value1> <value2> <PASS/FAIL/OPTION NOT INSTALLED>. The <test ID> field indicates which test was performed to retrieve these results. The < input1> and < input2> fields indicate the test setup. The <min> and <max> fields indicate the minimum and maximum values against which <value1> and <value2> were compared to arrive at the final PASS/FAIL result. If the specified test is not available in the instrument, the <PASS/FAIL> field will indicate "option not available" instead of "pass" or "fail". All unused fields for a given test are represented by a double dash ("--"). To receive valid measurements, the Pass/Fail measurement must be the active. The current measurement can be queried using CONFigure? Use the :CONFigure PFail command to set Pass/Fail as the active measurement.

Related Command: `MEASure:PFail?`
`:CONFigure PFail`
`READ:PFail?`

:FETCh:RF:ACPR?

Title: Fetch Adjacent Channel Power Ratio

Description: Returns the most recent adjacent channel power ratio measurement results.

Data is returned as 11 comma-delimited values: The Channel Power in dBm, relative adjacent channel 1 power level, absolute adjacent channel 1 power level, relative adjacent channel 2 power level, absolute adjacent channel 2 power level, relative adjacent channel 3 power level, absolute adjacent channel 3 power level, relative adjacent channel 4 power level, absolute adjacent channel 4 power level, relative adjacent channel 5 power level, absolute adjacent channel 5 power level. The relative adjacent channel power level is in dB and the absolute adjacent channel power level is in dBm. "--" is returned for each data that is not valid at that instance.

Related Command: `:CONFigure:RF ACPR`
`:MEASure:RF:ACPR?`
`:READ:RF:ACPR?`

Front Panel Access: **Measurements**, RF Measurements, ACPR

:FETCh:RF:PVTime?

Title: Fetch Power vs. Time

Description: Returns the most recent WiMAX 802.16-2004 OFDM signal over approximately one frame time domain measurement results.

Data is returned as 4 comma-delimited values: The Channel Power in dBm, Preamble power in dBm, burst power of data bursts in dBm, and the Crest Factor in dB. "--" is returned for each data that is not valid at that instance.

:FETCh:RF:SPECtrum?

Title: Fetch RF Spectrum

Description: Returns the most recent RF Spectrum measurement results.

Data is returned as 2 comma-delimited values: Channel Power(RSSI) in dBm and Occupied bandwidth measurement in MHz. "--" is returned for each data that is not valid at that instance.

Related Command:
```
:CONFigure:RF SPECtrum
:MEASure:RF:SPECtrum?
:READ:RF:SPECtrum?
```

Front Panel Access: **Measurements**, RF Measurements, Spectrum

7-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Title: Numeric Data Format

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units. This format requires many more bytes so it is the slowest format. INTeger 32 values are signed 32-bit integers in little-endian byte order. This format returns the data in 4-byte blocks. 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 instrument units.

Both INTeger,32 and REAL,32 formats return a definite block length. Each transfer begins with an ASCII header such as #42204. The first digit represents the number of following digits in the header (in this example, 4). The remainder of the header indicates the number of bytes that follow the header (in this example, 2204). You then divide the number of following bytes by the number of bytes in the data format you've chosen (4 for both INTeger,32 and REAL,32) to get the number of data points (in this example, 551).

Parameter: `ASCii|INTeger,32|REAL,32`

Parameter Type: <char>

Default Value: ASCii

Related Command: `:TRACe[:DATA]`

7-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Title: Continuous/Single Sweep

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 enters the “idle” state and waits for the :INITiate[:IMMediate] command or for :INITiate:CONTinuous ON. 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. Note that rapid toggling between ON and OFF is not allowed. The instrument must be allowed to make a full sweep before toggling can be done.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON

Related Command: `:INITiate[:IMMediate]`
`:INITiate:HOLD`

Front Panel Access: **Shift-3 (Sweep)**, Sweep

:INITiate[:IMMediate]

Title: Trigger Sweep/Measurement

Description: Initiates a sweep/measurement. If :INITiate:CONTinuous is set to ON, this command is ignored. Use this command in combination with :STATus:OPERation? 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.

Related Command: `:INITiate:CONTinuous`
`:STATus:OPERation?`

Front Panel Access: **Shift-3 (Sweep)**,Trigger Sweep

7-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:DEMod:CONStln?

Title: Measure Constellation

Description: Sets the active measurement to Constellation, sets the default measurement parameters, triggers a new measurement, and returns the EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID It is a combination of the commands :CONFigure:DEMod CONStln and :READ:DEMod:CONStln? To make a Demodulated Constellation measurement with settings other than the default values, send:

:CONFigure:DEMod CONStln
Commands to set desired settings
:READ:DEMod:CONStln?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:READ:DEMod:CONStln?`
`:CONFigure:DEMod CONStln`

:MEASure:DEMod:EVSCarrier?

Title: Measure EVM vs. Sub Carrier

Description: Sets the active measurement to EVM vs. Sub Carrier, sets the default measurement parameters, triggers a new measurement, and returns the EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. It is a combination of the commands :CONFigure:DEMod EVSCarrier and :READ:DEMod:EVSCarrier? To make an EVM vs. Symbol measurement with settings other than the default values, send:

:CONFigure:DEMod EVSCarrier
Commands to set the desired settings
:READ:DEMod:EVSCarrier?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:READ:DEMod:EVSCarrier?`
`:CONFigure:DEMod EVSCarrier`

:MEASure:DEMod:EVSYmbol?

Title: Measure EVM vs. Symbol

Description: Sets the active measurement to EVM vs. Symbol, sets the default measurement parameters, triggers a new measurement, and returns the EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. It is a combination of the commands :CONFigure:DEMod EVSYmbol and :READ:DEMod:EVSYmbol? To make an EVM vs. Symbol measurement with settings other than the default values, send:

:CONFigure:DEMod EVSYmbol
Commands to set the desired settings
:READ:DEMod:EVSYmbol?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:READ:DEMod:EVSYmbol?`
`:CONFigure:DEMod EVSYmbol`

:MEASure:DEMod:SFLatness?

Title: Measure Spectral Flatness

Description: Sets the active measurement to Spectral Flatness, sets the default measurement parameters, triggers a new measurement, and returns the absolute delta of the power between adjacent sub carriers in dB. It is a combination of the commands :CONFigure:DEMod SFLatness and :READ:DEMod:SFLatness? To make a Spectral Flatness measurement with settings other than the default values, send:

:CONFigure:DEMod SFLatness
Commands to set desired settings
:READ:DEMod:SFLatness?

Related Command: `:READ:DEMod:SFLatness?`
`:CONFigure:DEMod SFLatness`

:MEASure:PFail?

Title: Measure PASS/FAIL

Description: Sets the active measurement to PASS/FAIL, sets the default measurement parameters, triggers a new measurement and returns the PASS/FAIL results. It is a combination of the commands :CONFigure PFail and :READ:PFail? To make a PASS/FAIL measurement with settings other than the default values, send:

:CONFigure PFail
Commands to set desired settings
:READ:PFail?

Related Command: `:CONFigure PFail`
`READ:PFail?`
`FETCh:PFail?`

Front Panel Access: **Shift-4 (Measure)**, Pass/Fail Mode

:MEASure:RF:ACPR?

Title: Measure Adjacent Channel Power Ratio

Description: Sets the active measurement to ACPR, sets the default measurement parameters, triggers a new measurement, and returns the power levels for each channel (both absolute and relative). It is a combination of the commands :CONFigure:RF ACPR and :READ:RF:SPECtrum? To make an RF ACPR measurement with settings other than the default values, send:

:CONFigure:RF ACPR
Commands to set desired settings
:READ:RF:ACPR?

Data is returned as 11 comma-delimited values: The Channel Power in dBm, relative adjacent channel 1 power level, absolute adjacent channel 1 power level, relative adjacent channel 2 power level, absolute adjacent channel 2 power level, relative adjacent channel 3 power level, absolute adjacent channel 3 power level, relative adjacent channel 4 power level, absolute adjacent channel 4 power level, relative adjacent channel 5 power level, absolute adjacent channel 5 power level. The relative adjacent channel power level is in dB and the absolute adjacent channel power level is in dBm.

Related Command: `:READ:RF:ACPR?`
`:CONFigure:RF ACPR`
`:FETCh:RF:ACPR?`

Front Panel Access: **Measurements**, RF Measurements, ACPR

:MEASure:RF:PVTime?

Title: Measure Power vs. Time

Description: Sets the active measurement to Power vs. Time, sets the default measurement parameters, triggers a new measurement and returns the Channel Power, Preamble power, burst power of data bursts, and the Crest Factor. It is a combination of the commands :CONFigure:RF PVTime and :READ:RF:PVTime? To make an RF ACPR measurement with settings other than the default values, send:

:CONFigure:RF PVTime
Commands to set desired settings
:READ:RF:PVTime?

Data is returned as 4 comma-delimited values: The Channel Power in dBm, Preamble power in dBm, burst power of data bursts in dBm, and the Crest Factor in dB.

Related Command: `:READ:RF:PVTime?`
`:CONFigure:RF PVTime`

:MEASure:RF:SPECtrum?

Title: Measure RF Spectrum

Description: Sets the active measurement to Spectrum, sets the default measurement parameters, triggers a new measurement and returns the Channel Power (RSSI) and Occupied bandwidth measurement. It is a combination of the commands :CONFigure:RF SPECtrum and :READ:RF:SPECtrum? To make an RF Spectrum measurement with settings other than the default values, send:

:CONFigure:RF SPECtrum
Commands to set desired settings
:READ:RF:SPECtrum?

Data is returned as 2 comma-delimited values: Channel Power (RSSI) in dBm Occupied bandwidth measurement in MHz.

Related Command: `:CONFigure:RF SPECtrum`
`:READ:RF:SPECtrum?`
`:FETCh:RF:SPECtrum?`

Front Panel Access: **Measurements**, RF Measurements, Spectrum

7-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<file name>

Title: Recall Setup

Description: Recalls a previously stored instrument setup in the current save location. The setup file to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

Parameter: <integer>, <file name>

Related Command: `:MMEMory:STORe:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Recall (Select File to Recall)

:MMEMory:LOAD:TRACe <integer>,<file name>

Title: Recall Measurement

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use :INSTrument:SELect or :INSTrument:NSELect to set the mode. Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should contain a file extension. Note that the trace specified by <file name> should be available at the current save location. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

File name extensions:

“`.spa`” for SPA measurement
“`.mna`” for VNA and VVM measurements
“`.hipm`” for HiPM measurements
“`.pm`” for PM measurements
“`.cwsg`” for CWSG measurements
“`.afp`” for AM/FM/PM measurements
“`.ia`” for Interference Analysis measurements
“`.cs`” for Channel Scanner measurements
“`.wmxd`” for WiMAX
“`.wmxe`” for Mobile WiMAX
“`.lte`” for LTE measurements
“`.p25`” for P25 measurements
“`.p252`” for P25p2 measurements
“`.nxdn`” for NXDN measurements
“`.dpmr`” for dPMR measurements
“`.dmr2`” for DMR 2 measurements
“`.ptc`” for PTC measurements
“`.tetra`” for TETRA measurements
“`.nbfm`” for NBFM measurements

Parameter: <integer>, <file name>

Example: To recall trace with file name “trace”:

`:MMEMory:LOAD:TRACe 1,”trace.wmxd”`

Related Command: `:MMEMory:STORe:TRACe`
`:MMEMory:STORe:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Recall Measurement

:MMEMory:STORe:STATe <integer>,<file name>

Title: Save Setup

Description: Stores the current setup into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a value of 0.

Parameter: <integer>, <file name>

Related Command: `:MMEMory:LOAD:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**

:MMEMory:STORe:TRACe <integer>,<file name>

Title: Save Measurement

Description: Stores the trace into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 0.

Parameter: <integer>, <file name>

Example: To save the trace into the file name “trace”:

`:MMEMory:STORe:TRACe 0,”trace”`

Related Command: `:MMEMory:LOAD:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Save

7-9 :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:DEMod:CONStln?

Title: Read Constellation

Description: Triggers a new Constellation measurement and returns the results: EVM (rms),
EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. The Constellation measurement must be the active measurement (specified by :CONFigure:DEMod CONStln). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:FETCh:DEMod:CONStln?`
`:CONFigure:DEMod CONStln`

:READ:DEMod:EVSCarrier?

Title: Read EVM vs. Sub Carrier

Description: Triggers a new EVM vs. Sub Carrier measurement and returns the results: EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. The EVM vs. Sub Carrier measurement must be the active measurement (specified by :CONFigure:DEMod EVSCarrier). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:FETCh:DEMod:EVSCarrier?`
`:CONFigure:DEMod EVSCarrier`

:READ:DEMod:EVSYmbol?

Title: Read EVM vs. Symbol

Description: Triggers a new EVM vs. Symbol measurement and returns the results: EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID The EVM vs. Symbol measurement must be the active measurement (specified by :CONFigure:DEMod EVSYmbol). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:FETCh:DEMod:EVSYmbol?`
`:CONFigure:DEMod EVSYmbol`

:READ:DEMod:SFLatness?

Title: Read Spectral Flatness

Description: Triggers a new Spectral Flatness measurement and returns the absolute delta of the power between adjacent sub carriers in dB. The Spectral Flatness measurement must be the active measurement (specified by :CONFigure:DEMod SFLatness). The current measurement can be queried using the command :CONFigure?

Related Command: `:FETCh:DEMod:SFLatness?`
`:CONFigure:DEMod SFLatness`

:READ:PFail?

Title: Read PASS/FAIL

Description: Triggers a new PASS/FAIL measurement and returns the results. It is a combination of the commands :ABORT; :INITiate; :FETCh:PFail? The PASS/FAIL measurement must be active. The current measurement can be queried using :CONFigure?

Related Command: `:FETCh:PFail?`
`:CONFigure PFail`
`:MEASure:PFail?`

Front Panel Access: **Measurements**, Pass/Faile Mode

:READ:RF:ACPR?

Title: Read Adjacent Channel Power Ratio

Description: Triggers a new Adjacent Channel Power Ratio measurement and returns the results: Power levels for each channel (both absolute and relative). It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:ACPR? The ACPR measurement must be the active measurement (specified by :CONFigure:RF ACPR). The current measurement can be queried using :CONFigure?

Data is returned as 11 comma-delimited values: The Channel Power in dBm, relative adjacent channel 1 power level, absolute adjacent channel 1 power level, relative adjacent channel 2 power level, absolute adjacent channel 2 power level, relative adjacent channel 3 power level, absolute adjacent channel 3 power level, relative adjacent channel 4 power level, absolute adjacent channel 4 power level, relative adjacent channel 5 power level, absolute adjacent channel 5 power level. The relative adjacent channel power level is in dB and the absolute adjacent channel power level is in dBm.

Related Command: `:FETCh:RF:ACPR?`
`:CONFigure:RF ACPR`
`:MEASure:RF:ACPR?`

Front Panel Access: **Measurements**, RF Measurements, ACPR

:READ:RF:PVTime?

Title: Read Power vs. Time

Description: Triggers a new Power vs. Time measurement and returns the results: Channel Power, Preamble power, burst power of data bursts, and the Crest Factor. It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:PVTime? The Power vs. Time measurement must be the active measurement (specified by :CONFigure:RF PVTime). The current measurement can be queried using :CONFigure?

Data is returned as 4 comma-delimited values: The Channel Power in dBm, Preamble power in dBm, burst power of data bursts in dBm, and the Crest Factor in dB.

Related Command: `:FETCh:RF:PVTime?`
`:CONFigure:RF PVTime`

:READ:RF:SPECtrum?

Title: Read RF Spectrum

Description: Triggers a new RF Spectrum measurement and returns the results: Channel Power (RSSI) and Occupied bandwidth measurement. It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:SPECtrum? The Spectrum measurement must be the active measurement (specified by :CONFigure:RF SPECtrum). The current measurement can be queried using :CONFigure?

Data is returned as 2 comma-delimited values: Channel Power(RSSI) in dBm and Occupied bandwidth measurement in MHz.

Related Command: `:FETCh:RF:SPECtrum?`
`:CONFigure:RF SPECtrum`
`:MEASure:RF:SPECtrum?`

7-10 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble? <trace type>

Title: Returns trace header information for the specified trace. The <trace type> must be one of the following:
SPECtrum | PVTime | ACPR | CONStln | SFLatness | EVSCarrier | EVSYmbol

Data can be transferred to and from the 7 available display trace types. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It looks like #AX, where A is the number of digits in X and X is the number of bytes that follow the header. Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "NAME=VALUE[UNITS]," Valid parameter names are shown in Table 7-1, "Available Parameters in WiMAX and Mobile WiMAX Mode" on page 7-22.

Parameter: `<trace type>`

Related Command: `:TRACe:DATA?`

WiMAX, Mobile WiMAX Parameter Names

Table 7-1. Available Parameters in WiMAX and Mobile WiMAX Mode (Sheet 1 of 3)

Parameter Name	Description
SN	Instrument serial #
UNIT_NAME	Instrument name
TYPE	The data type (Setup or Data)
DESCR	Trace name
DATE	Trace date/time
BASE_VER	Base FW version
APP_NAME	Application name
APP_VER	Application FW version
APP_MODE	Application Mode
REFERENCE_LEVEL	Reference Level
UNITS	Amplitude units
SCALE	Y axis scale
CENTER_FREQ	Center freq
SIGNAL_STANDARD	Current signal standard (the value is the index of the signal standard list, where a value of 0 is the first index in the list)

Table 7-1. Available Parameters in WiMAX and Mobile WiMAX Mode (Sheet 2 of 3)

Parameter Name	Description
CHANNEL	Current channel
POWER_OFFSET	Applied power offset
REFERENCE_FREQUENCY	Selected external reference frequency
UNITS	Amplitude units
CURRENT_VIEW	Current view
CURRENT_MEASURMENTS	Current measurements
DYNAMIC_ATTENUATION	Dynamic range on/off
SPAN	Frequency span
PVT_FRAME_START_TIME	Power vs. Time start time
PVT_FRAME_STOP_TIME	Power vs. Time stop time
BW_SELECT	Current Bandwidth (MHz)
CURRENT_SPECTRUM_VIEW	Current spectrum view (single or multiple channel spectrum)
I_Q_VIEW	IQ view
RUN_HOLD	Run/Hold on/off
TEST_MODEL	Current pass fail model being tested
CP_RATIO	Cyclic Prefix Ratio (the value is the index of the CP Ratio list, where a value of 0 is the first index in the list)
SPECTRUM_SPAN	Spectrum frequency span (the value is the index of the span list, where a value of 0 is the first index in the list
AUTO_SPAN	Auto span on/off
MAX_HOLD	Max hold on/off
EVM_SUB_CARRIER_TOP	Y Axis Max for EVM vs. Symbol/Sub-Carrier
EVM_SUB_CARRIER_SCALE	EVM vs. Symbol/Sub-Carrier scale
SPECTRAL_FLATNESS_SCALE	Spectral Flatness scale
ACPR_DISPLAY_GRAPH	Display ACPR trace on/off
NUM_OF_ACPR_MAIN_CHANNELS	Number of main channels
NUM_OF_ACPR_ADJC_CHANNELS	Number of adjacent channels
CONSTELLATION_REFERENCE_POINTS	Constellation reference points on/off
SPECTRAL_FLATNESS_TOP	Y Axis Max for Spectral Flatness
SPECTRAL_FLATNESS_EVM_SUB_START	Spectral Flatness/EVM vs. sub-carrier start
SPECTRAL_FLATNESS_EVM_SUB_STOP	Spectral Flatness/EVM vs. sub-carrier stop
EVM_SYM_START	EVM vs. Symbol start

Table 7-1. Available Parameters in WiMAX and Mobile WiMAX Mode (Sheet 3 of 3)

Parameter Name	Description
EVM_SYM_STOP	EVM vs. Symbol stop

:TRACe[:DATA]? <trace type>

Title: Trace Data Transfer

Description: This command transfers trace data from the instrument to the controller. The <trace type> must be one of the following: SPECtrum | PVTime | CONStln | SFLatness | EVSCarrier | EVSYmbol.

The format of the block data in the query form is specified by :FORMat:DATA. The block data in the command form is always sent in ASCII format. The response begins with an ASCII header that 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 that follow the header. Each data point is separated by a comma delimiter. Trace setup information can be acquired using :TRACe[:DATA]:PREamble?

Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. Except for CONStln there is only one value per data point. If max hold is set to ON for SPECtrum and EVM vs. Sub Carrier then the max hold value is returned. For CONStln, each data point is represented by 3 values 4 bytes each: IData (no units), QData (no units), and the constellation type (no units). For SPECtrum and PVTime unit is in dBm. For Spectral Flatness unit is in dB. For EVM vs Sub Carrier and EVM vs Symbol unit is in percent. Note that the instrument must be set in the selected view. Use the CONFigure command to set the unit to the selected view.

Parameter: `<trace type>`

Related Command: `:FORMat[:DATA]`
`:TRACe[:DATA]:PREamble?`

7-11 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:BANDwidth|BWIDth[:RESolution] <index>
[:SENSe]:BANDwidth|BWIDth[:RESolution]?

Title: Resolution Bandwidth

Description: Sets the resolution bandwidth. The <index> argument is a 1-based index of the position of the desired bandwidth in the instrument's current bandwidth list. The list can be displayed on the instrument by choosing the "BW" submenu button in the "Setup" menu. For example, if the desired bandwidth is the 3rd item on the list then the value of the <index> argument would be 3.

The query form of this command will return the index of the currently selected bandwidth on the list. The Default is the 1st index in the bandwidth list.

Parameter: `<index>`

Default Value: The default bandwidth is 1.25MHz which is the 1st index in the bandwidth list.

Front Panel Access: **Setup**, BW

[:SENSe]:CPRatio <index>
[:SENSe]:CPRatio?

Title: Cyclic Prefix Ratio (G)

Description: Selects the desired Cyclic Prefix Ratio from the list. The <index> argument is a 1-based index of the position of the desired CP Ratio in the instrument's current CP Ratio list. The list can be displayed on the instrument by choosing the "CP Ratio (G)" submenu button in the "Setup" menu. For example, if the desired CP Ratio is the 3rd item on the list then the value of the <index> argument would be 3.

The query form of this command will return the index of the currently selected CP Ratio on the list. The default CP ratio is the first index in the CP ratio list.

Parameter: `<index>`

Default Value: The default CP Ratio is 1/4 which is the 1st index in the CP Ratio list.

Front Panel Access: **Setup**, CP Ratio (G)

[:SENSe]:DEMod:CONStln:POINts?

Title: Number of Constellation Point

Required Option: 47

Description: Queries the number of Constellation points.

[:SENSe]:DEMod:CONStln:REFPoints[:STATe] OFF|ON|0|1
[:SENSe]:DEMod:CONStln:REFPoints[:STATe]?

Title: Constellation Reference Points

Required Option: 47

Description: Sets the display of the reference points for the various constellations on/off. The query will return 1 for ON and 0 for OFF.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: 1

Front Panel Access: **Shift 4 (Measure)**, Demodulator, Constellation, Reference Points

[:SENSe]:DEMod:EVSCarrier:STARt:X?

Title: EVM vs. Sub Carrier Start Value

Description: Queries the EVM vs. Sub Carrier start value.

Related Command: `:DEMod:EVSCarrier:STOP:X?`

[:SENSe]:DEMod:EVSCarrier:STOP:X?

Title: EVM vs. Sub Carrier Stop Value

Description: Queries the EVM vs. Sub Carrier stop value.

Related Command: `:DEMod:EVSCarrier:STARt:X?`

[:SENSe]:DEMod:EVSYmbol:STARt:X?

Title: EVM vs. Symbol Start Value

Description: Queries the EVM vs. Symbol start value.

Related Command: `:DEMod:EVSYmbol:STOP:X?`

[:SENSe]:DEMod:EVSYmbol:STOP:X?

Title: EVM vs. Symbol Stop Value

Description: Queries the EVM vs. Symbol stop value.

Related Command: `:DEMod:EVSYmbol:STARt:X?`

[:SENSe]:DEMod:SFLatness:STARt:X?

Title: Spectral Flatness Start Value

Description: Queries the Spectral Flatness start value.

Related Command: `:DEMod:SFLatness:STOP:X?`

[:SENSe]:DEMod:SFLatness:STOP:X?

Title: Spectral Flatness Stop Value

Description: Queries the Spectral Flatness stop value.

Related Command: `:DEMod:SFLatness:STARt:X?`

[:SENSe]:DLFLength 2.5|5|10
[:SENSe]:DLFLength?

Title: Down Link Frame Length

Description: Sets the Down Link Frame Length, in milliseconds.

The query form of this command will return the Down Link Frame Length in seconds (not milliseconds).

Parameter: `2.5|5|10`

Default Value: 2500 us

Default Unit: seconds

Front Panel Access: **Setup**, Frame Length

[:SENSe]:FREQuency:CENTer <freq>
[:SENSe]:FREQuency:CENTer?

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.

Parameter: <freq>

Default Value: `2.5 GHz`

Default Unit: Hz

Range: 0 Hz to 7.1 GHz

Front Panel Access: **Freq**, Center Freq

[:SENSe]:FREQuency:SIGStandard:CHANnel <number>
[:SENSe]:FREQuency:SIGStandard:CHANnel?

Title: Channel Selection

Description: Sets the channel number for the selected signal standard.

Parameter: <number>

Front Panel Access: **Freq**, Channel

[:SENSe]:FREQuency:SIGStandard:NAMe <string>
[:SENSe]:FREQuency:SIGStandard:NAMe?

Title: Signal Standard

Description: Selects the desired signal standard from the list. The <string> argument is the name of the desired signal standard as displayed in the instrument's current signal standard list. The list can be displayed on the instrument by choosing the Signal Standard submenu button in the Freq menu. The list can also be downloaded remotely and viewed using Anritsu Master Software Tools. For example, if the desired Signal Standard is P-GSM 900 - Uplink, the value of the <string> argument would be "P-GSM 900 - Uplink".

The query form of this command will return the name of the currently selected Signal Standard on the list.

Parameter: <string>

Front Panel Access: **Freq**, Signal Standard

[:SENSe]:PFail <test set>
[:SENSe]:PFail?

Title: PASS/FAIL Test Selection

Description: Selects the active test set to be used in subsequent PASS/FAIL measurements. The <test set> value must correspond to a test set that is defined in the test set list. To view the list on the instrument, go into the "Measurement" menu, press the "Pass/Fail Mode" key, and then press the "Select Pass/Fail Test" submenu. Alternatively, the list can be retrieved remotely and viewed using the Anritsu Master Software Tools. The <test set> argument is a 1-based index of the position of the desired Pass/Fail test set in the instrument's current Pass/Fail test set list. For example, if the desired Pass/Fail test is the 3rd item on the list, the value of the <test set> argument would be 3.

When using the query form of the command, the return value is the currently selected test set number. If there is not a valid test set selected, the return value is "-1" (negative 1).

Parameter: `<test set>`

Related Command: `:CONFigure PFail`

Front Panel Access: **Measurements**, Pass/Fail Mode, Select Pass/Fail Test

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Title: Automatic Amplitude Range

Description: Sets the automatic amplitude range. Setting the value to ON or 1 will result in the amplitude range being coupled to the detected input signal level. Setting the value to OFF or 0 will result in the input attenuation being un-coupled from the input signal level. That is, changing the input signal level will not change the amplitude range. When this command is issued, the amplitude range itself will not change. The default value is ON. That is, sending :SENS:POW:RANG:AUTO is equivalent to sending :SENS:POW:RANG:AUTO ON.

Parameter: OFF|ON|0|1

Parameter Type: `<boolean>`

Default Value: ON

Related Command: `:POWer[:RF]:RANGe`

Front Panel Access: **Amplitude**, Auto Range

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Title: Amplitude Range

Description: Re-calculates amplitude range. Note that issuing this command will set the automatic dynamic range OFF.

Related Command: `:POWer[:RF]:RANGe:AUTO`

Front Panel Access: **Amplitude**, Adjust Range

[:SENSe]:RF:ACPR:ADJCchannelcount?

Title: ACPR ADJC Channel Count

Description: Returns the number of Adjacent channels in the ACPR view.

Range: 1 to 4

[:SENSe]:RF:ACPR:MAINchannelcount?

Title: ACPR MAIN Channel Count

Description: Returns the number of main channels in the ACPR view.

Range: 1 to 4

[:SENSe]:RF:PVTime:FRAMe:STARt?

Title: Power vs. Time Frame Start Time

Description: Queries the Power vs. Time Frame start time.

Default Unit: seconds

Related Command: `:RF:PVTime:FRAMe:STOP?`
`:DLFLength?`

[:SENSe]:RF:PVTime:FRAMe:STOP?

Title: Power vs. Time Frame Stop Time

Description: Queries the Power vs. Time frame stop time.

Default Unit: seconds

Related Command: `:RF:PVTime:FRAMe:STARt?`
`:DLFLength?`

[:SENSe]:RF:SPECtrum:SPAN 5|10|20|30
[:SENSe]:RF:SPECtrum:SPAN?

Title: Spectrum View Span

Description: Sets the span for the Spectrum view. Setting the value to 5 will set the span for the Spectrum view to 5 MHz. Setting the value to 10 will set the span for the Spectrum view to 10 MHz. Setting the value to 20 will set the span for the Spectrum view to 20 MHz. Setting the value to 30 will set the span for the Spectrum view to 30 MHz.

Parameter: `5|10|20|30`

Default Value: 5 MHz

Default Unit: MHz

Front Panel Access: **Measurements**, RF Measurements, Spectrum, Span

Chapter 8 — Mobile WiMAX Commands

8-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Title: Abort

Description: Restarts the current sweep and/or measurement. Resets the trigger system. 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.

Parameter: NA

Related Command: `:INITiate:CONTinuous`
`:INITiate[:IMMediate]`

8-2 :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 PFail`

Title: Configure PASS/FAIL Measurement

Description: This command configures the PASS/FAIL measurement. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe] commands before initiating a measurement. The measurement results are equivalent to the results that are displayed by choosing Measurements, then PASS/FAIL from the front panel.

Parameter: `PFail`

Related Command: `:FETCh:PFail?`
`MEASure:PFail?`
`READ:PFail?`

Front Panel Access: **Measurements**, Pass/Fail Mode

`:CONFigure SUMMary`

Title: Configure Summary Measurement

Description: This command configures the summary of all the related numerical measurement results. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe] commands before initiating a measurement.

Parameter: SUMMary

Parameter Type: <char>

Front Panel Access: **Measurements**, WiMAX Summary

:CONFigure:DEMod <char>

Title: Configure Demodulation Measurement

Required Option: 47

Description: Valid <char> parameters are:
SUMMary | CONStln | SFLatness | EVSCarrier | EVSYmbol.

This command configures the selected demodulation measurement. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe]:DEMod commands before initiating a measurement.

When the SUMMARY option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator, then Modulation Summary from the front panel. When the CONStln option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator, then Constellation from the front panel. When the SFLatness option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator, then Spectral Flatness from the front panel. When the EVSCarrier option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator then EVM vs Sub Carrier from the front panel. When the EVSYmbol option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then Demodulator then EVM vs Symbol from the front panel.

Parameter: `<char>`

Front Panel Access: **Measurements**, Demodulator

:CONFigure:RF <char>

Title: Configure RF Measurement

Required Option: 46

Description: Valid parameter options: SUMMary | SPECtrum | PVTime | ACPR

This command configures the selected RF measurement. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe]:RF commands before initiating a measurement.

When the SUMMary option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then RF Summary from the front panel. When the SPECtrum option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then Spectrum from the front panel. When the PVTime option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then Power vs Time from the front panel. When the ACPR option is selected, the measurement results are equivalent to the results that are displayed by choosing Measurements, then RF, then ACPR from the front panel.

Parameter: `<char>`

Related Command: `:FREQuency`

8-3 :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:WINDow:TRACe:MAXHold OFF|ON|0|1
:DISPlay:WINDow:TRACe:MAXHold?

Title: Max Hold State

Description: Specifies whether the Max Hold is ON or OFF. The default value is ON. That is, sending :DISP:WIND:TRAC:MAXH is equivalent to sending :DISP:WIND:TRAC:MAXH ON. The query version of the command returns a 1 if Max Hold is set to ON and returns a 0 if the Max Hold is set to OFF. Note that this command is available only in the Spectrum and EVM vs. Sub-carrier views.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: 0

Front Panel Access: **Shift-5 (Trace)**, Max Hold

:DISPlay:WINDow:TRACe:Y[:SCALe]:OFFSet <rel ampl>
:DISPlay:WINDow:TRACe:Y[:SCALe]:OFFSet?

Title: Power Offset

Description: Sets the power offset value for the y-axis.

Parameter: <rel ampl>

Default Value: 0 dB

Default Unit: dB

Range: 0 dB to 100 dB

Front Panel Access: **Amplitude**, Power Offset

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Title: Scale Resolution Per Division

Description: Sets the scale per division for the y-axis. The units change from dB/div to % when EVM is the y-axis value. The resolution per division value is maintained separately for each measurement.

Parameter: `<value>`

Default Value: Spectral Flatness: 1 dB/div
EVM vs. SubCarrier: 0.50%
EVM vs. Symbol: 0.50%
All others: 10dB/div

Default Unit: Current active amplitude unit

Range: EVM vs. SubCarrier: 0.1 % to 10 %
EVM vs. SubCarrier: 0.1 % to 10 %
All others: 1 dB to 15 dB

:DISPlay:WINDow:TRACe:Y[:SCALe]:TOP <amplitude>
:DISPlay:WINDow:TRACe:Y[:SCALe]:TOP?

Title: Y Axis Max

Description: Sets the maximum value of the Y axis. Note that this command is available only in the Spectral Flatness and EVM vs. Symbol/Sub-carrier views.

Parameter: `<amplitude>`

Default Value: Spectral Flatness: 5dB
EVM vs. Symbol: 5%
EVM vs. Sub-carrier: 5%

Default Unit: Current active amplitude unit

Range: Spectral Flatness: -5dB to 5dB
EVM vs. Symbol: 1% to 100%
EVM vs. Sub-carrier: 1% to 100%

Front Panel Access: **Amplitude**, Y Axis Max

8-4 :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:DEMod:CONStln?

Title: Fetch Constellation

Description: Returns the constellation of the demodulated data symbol over one frame measurement results.

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID. "--" is returned for each data that is not valid at that instance.

:FETCh:DEMod:EVSCarrier?

Title: Fetch EVM vs. Sub Carrier

Description: Returns the EVM vs. Sub Carrier measurement results.

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID. "--" is returned for each data that is not valid at that instance.

:FETCh:DEMod:EVSYmbol?

Title: Fetch EVM vs. Symbol

Description: Returns the EVM vs. Symbol measurement results.

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %,
RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID. "--" is returned for each data that is not valid at that instance.

:FETCh:DEMod:SFLatness?

Title: Fetch Spectral Flatness

Description: Returns the absolute delta of the power between adjacent sub carriers in dB. "--" is returned for data that is not valid at that instance.

:FETCh:PFail?

Title: Fetch PASS/FAIL

Description: Returns the most recent PASS/FAIL measurement results. Measurement results are returned in a block of ASCII text in the format of <header><block>. The ASCII 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 block consists of a set of records which indicate individual test results. Records are comma-separated. Each record follows the format <test ID>: <input1> <input2> <min> <max> <value1> <value2> <PASS/FAIL/OPTION NOT INSTALLED>.

The <test ID> field indicates which test was performed to retrieve these results. The < input1> and < input2> fields indicate the test setup. The <min> and <max> fields indicate the minimum and maximum values against which <value1> and <value2> were compared to arrive at the final PASS/FAIL result. If the specified test is not available in the instrument, the <PASS/FAIL> field will indicate “option not available” instead of “pass” or “fail”. All unused fields for a given test are represented by a double dash (“--”). To receive valid measurements, the Pass/Fail measurement must be the active. The current measurement can be queried using CONFigure? Use the :CONFigure PFail to set Pass/Fail as the active measurement.

Related Command: `:MEASure:PFail?`
`:CONFigure PFail`
`:READ:PFail?`

:FETCh:RF:ACPR?

Title: Fetch Adjacent Channel Power Ratio

Description: Returns the most recent adjacent channel power ratio measurement results.

Data is returned as 11 comma-delimited values: The Channel Power in dBm, relative adjacent channel 1 power level, absolute adjacent channel 1 power level, relative adjacent channel 2 power level, absolute adjacent channel 2 power level, relative adjacent channel 3 power level, absolute adjacent channel 3 power level, relative adjacent channel 4 power level, absolute adjacent channel 4 power level, relative adjacent channel 5 power level, absolute adjacent channel 5 power level. The relative adjacent channel power level is in dB and the absolute adjacent channel power level is in dBm. “--” is returned for each data that is not valid at that instance.

Related Command: `:CONFigure:RF ACPR`
`:MEASure:RF:ACPR?`
`:READ:RF:ACPR?`

Front Panel Access: **Measurements**, RF Measurements, ACPR

:FETCh:RF:PVTime?

Title: Fetch Power vs. Time

Description: Returns the most recent WiMAX 802.16-2004 OFDM signal over approximately one frame time domain measurement results.

Data is returned as 4 comma-delimited values: The Channel Power in dBm, Preamble power in dBm, downlink burst power of data bursts in dBm, and uplink burst power of data bursts in dBm. "--" is returned for each data that is not valid at that instance.

:FETCh:RF:SPECtrum?

Title: Fetch RF Spectrum

Description: Returns the most recent RF Spectrum measurement results.

Data is returned as 2 comma-delimited values: Channel Power(RSSI) in dBm and Occupied bandwidth measurement in MHz. "--" is returned for each data that is not valid at that instance.

Related Command: `:CONFigure:RF SPECtrum`
`:MEASure:RF:SPECtrum?`
`:READ:RF:SPECtrum?`

8-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Title: Numeric Data Format

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units. This format requires many more bytes so it is the slowest format. INTeger 32 values are signed 32-bit integers in little-endian byte order. This format returns the data in 4-byte blocks. 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 instrument units.

Both INTeger,32 and REAL,32 formats return a definite block length. Each transfer begins with an ASCII header such as #42204. The first digit represents the number of following digits in the header (in this example, 4). The remainder of the header indicates the number of bytes that follow the header (in this example, 2204). You then divide the number of following bytes by the number of bytes in the data format you've chosen (4 for both INTeger,32 and REAL,32) to get the number of data points (in this example, 551).

Parameter: `ASCii|INTeger,32|REAL,32`

Parameter Type: <char>

Default Value: ASCii

Related Command: `:TRACe[:DATA]`

8-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Title: Continuous/Single Sweep

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 enters the “idle” state and waits for the :INITiate[:IMMediate] command or for :INITiate:CONTinuous ON. 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. Note that rapid toggling between ON and OFF is not allowed. The instrument must be allowed to make a full sweep before toggling can be done.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON

Related Command: `:INITiate[:IMMediate]`
`:INITiate:HOLD`

Front Panel Access: **Shift-3 (Sweep)**, Sweep

:INITiate[:IMMediate]

Title: Trigger Sweep/Measurement

Description: Initiates a sweep/measurement. If :INITiate:CONTinuous is set to ON, this command is ignored. Use this command in combination with :STATus:OPERation? 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.

Related Command: `:INITiate:CONTinuous`
`:STATus:OPERation?`

Front Panel Access: **Shift-3 (Sweep)**, Trigger Sweep

8-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:DEMod:CONStln?

Title: Measure Constellation

Description: Sets the active measurement to Constellation, sets the default measurement parameters, triggers a new measurement, and returns the EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. It is a combination of the commands :CONFigure:DEMod CONStln and :READ:DEMod:CONStln? To make a Demodulated Constellation measurement with settings other than the default values, send:

:CONFigure:DEMod CONStln
Commands to set desired settings
:READ:DEMod:CONStln?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Freq Error in MHz, CINR in dB, Base Station ID, and the Sector ID.

Related Command: `:READ:DEMod:CONStln?`
`:CONFigure:DEMod CONStln`

:MEASure:DEMod:EVSCarrier?

Title: Measure EVM vs. Sub Carrier

Description: Sets the active measurement to EVM vs. Sub Carrier, sets the default measurement parameters, triggers a new measurement, and returns the EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. It is a combination of the commands :CONFigure:DEMod EVSCarrier and :READ:DEMod:EVSCarrier? To make an EVM vs. Symbol measurement with settings other than the default values, send:

:CONFigure:DEMod EVSCarrier
Commands to set the desired settings
:READ:DEMod:EVSCarrier?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:READ:DEMod:EVSCarrier?`
`:CONFigure:DEMod EVSCarrier`

:MEASure:DEMod:EVSYmbol?

Title: Measure EVM vs. Symbol

Description: Sets the active measurement to EVM vs. Symbol, sets the default measurement parameters, triggers a new measurement, and returns the EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. It is a combination of the commands :CONFigure:DEMod EVSYmbol and :READ:DEMod:EVSYmbol? To make an EVM vs. Symbol measurement with settings other than the default values, send:

:CONFigure:DEMod EVSYmbol
Commands to set the desired settings
:READ:DEMod:EVSYmbol?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:READ:DEMod:EVSYmbol?`
`:CONFigure:DEMod EVSYmbol`

:MEASure:DEMod:SFLatness?

Title: Measure Spectral Flatness

Description: Sets the active measurement to Spectral Flatness, sets the default measurement parameters, triggers a new measurement, and returns the absolute delta of the power between adjacent sub carriers in dB. It is a combination of the commands :CONFigure:DEMod SFLatness and :READ:DEMod:SFLatness? To make a Spectral Flatness measurement with settings other than the default values, send:

:CONFigure:DEMod SFLatness
Commands to set desired settings
:READ:DEMod:SFLatness?

Related Command: `:READ:DEMod:SFLatness?`
`:CONFigure:DEMod SFLatness`

:MEASure:PFail?

Title: Measure PASS/FAIL

Description: Sets the active measurement to PASS/FAIL, sets the default measurement parameters, triggers a new measurement and returns the PASS/FAIL results. It is a combination of the commands :CONFigure PFail and :READ:PFail? To make a PASS/FAIL measurement with settings other than the default values, send:

:CONFigure PFail
Commands to set desired settings
:READ:PFail?

Related Command: `:CONFigure PFail`
`:READ:PFail?`
`:FETCh:PFail?`

Front Panel Access: **Measurements**, Pass/Faile Mode

:MEASure:RF:ACPR?

Title: Measure Adjacent Channel Power Ratio

Description: Sets the active measurement to ACPR, sets the default measurement parameters, triggers a new measurement, and returns the power levels for each channel (both absolute and relative). It is a combination of the commands :CONFigure:RF ACPR and :READ:RF:SPECtrum? To make an RF ACPR measurement with settings other than the default values, send:

:CONFigure:RF ACPR
Commands to set desired settings
:READ:RF:ACPR?

Data is returned as 11 comma-delimited values: The Channel Power in dBm, relative adjacent channel 1 power level, absolute adjacent channel 1 power level, relative adjacent channel 2 power level, absolute adjacent channel 2 power level, relative adjacent channel 3 power level, absolute adjacent channel 3 power level, relative adjacent channel 4 power level, absolute adjacent channel 4 power level, relative adjacent channel 5 power level, absolute adjacent channel 5 power level. The relative adjacent channel power level is in dB and the absolute adjacent channel power level is in dBm.

Related Command: `:READ:RF:ACPR?`
`:CONFigure:RF ACPR`
`:FETCh:RF:ACPR?`

Front Panel Access: **Measurements**, RF Measurements, ACPR

:MEASure:RF:PVTime?

Title: Measure Power vs. Time

Description: Sets the active measurement to Power vs. Time, sets the default measurement parameters, triggers a new measurement and returns the Channel Power, Preamble power, burst power of data bursts, and the Crest Factor. It is a combination of the commands :CONFigure:RF PVTime and :READ:RF:PVTime? To make an RF ACPR measurement with settings other than the default values, send:

:CONFigure:RF PVTime
Commands to set desired settings
:READ:RF:PVTime?

Data is returned as 4 comma-delimited values: The Channel Power in dBm, Preamble power in dBm, burst power of data bursts in dBm, and the Crest Factor in dB.

Related Command: `:READ:RF:PVTime?`
`:CONFigure:RF PVTime`

:MEASure:RF:SPECtrum?

Title: Measure RF Spectrum

Description: Sets the active measurement to Spectrum, sets the default measurement parameters, triggers a new measurement and returns the Channel Power (RSSI) and Occupied bandwidth measurement. It is a combination of the commands :CONFigure:RF SPECtrum and :READ:RF:SPECtrum? To make an RF Spectrum measurement with settings other than the default values, send:

:CONFigure:RF SPECtrum
Commands to set desired settings
:READ:RF:SPECtrum?

Data is returned as 2 comma-delimited values: Channel Power (RSSI) in dBm Occupied bandwidth measurement in MHz.

Related Command: `:CONFigure:RF SPECtrum`
`:READ:RF:SPECtrum?`
`:FETCh:RF:SPECtrum?`

Front Panel Access: **Measurements**, RF Measurements, Channel Spectrum

8-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

`:MMEMory:LOAD:STATe <integer>,<file name>`

Title: Recall Setup

Description: Recalls a previously stored instrument setup in the current save location. The setup file to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

Parameter: <integer>, <file name>

Related Command: `:MMEMory:STORe:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Recall

:MMEMory:LOAD:TRACe <integer>,<file name>

Title: Recall Measurement

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use :INSTrument:SELect or :INSTrument:NSELect to set the mode. Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should contain a file extension. Note that the trace specified by <file name> should be available at the current save location. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

File name extensions:

“`.spa`” for SPA measurement
“`.mna`” for VNA and VVM measurements
“`.hipm`” for HiPM measurements
“`.pm`” for PM measurements
“`.cwsg`” for CWSG measurements
“`.afp`” for AM/FM/PM measurements
“`.ia`” for Interference Analysis measurements
“`.cs`” for Channel Scanner measurements
“`.wmxd`” for WiMAX
“`.wmxe`” for Mobile WiMAX
“`.lte`” for LTE measurements
“`.p25`” for P25 measurements
“`.p252`” for P25p2 measurements
“`.nxdn`” for NXDN measurements
“`.dpmr`” for dPMR measurements
“`.dmr2`” for DMR 2 measurements
“`.ptc`” for PTC measurements
“`.tetra`” for TETRA measurements
“`.nbfm`” for NBFM measurements

Parameter: <integer>, <file name>

Example: To recall trace with file name “trace”:

`:MMEMory:LOAD:TRACe 1,”trace.wmxe”`

Related Command: `:MMEMory:STORe:TRACe`
`:MMEMory:STORe:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Recall Measurement

:MMEMory:STORe:STATe <integer>,<file name>

Title: Save Setup

Description: Stores the current setup into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a value of 0.

Parameter: <integer>, <file name>

Related Command: `:MMEMory:LOAD:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**

:MMEMory:STORe:TRACe <integer>,<file name>

Title: Save Measurement

Description: Stores the trace into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 0.

Parameter: <integer>, <file name>

Example: To save the trace into the file name “trace”:

`:MMEMory:STORe:TRACe 0,”trace”`

Related Command: `:MMEMory:LOAD:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: **Shift-7 (File)**, Save

8-9 :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:DEMod:CONStln?

Title: Read Constellation

Description: Triggers a new Constellation measurement and returns the results: EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. The Constellation measurement must be the active measurement (specified by :CONFigure:DEMod CONStln). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:FETCh:DEMod:CONStln?`
`:CONFigure:DEMod CONStln`

:READ:DEMod:EVSCarrier?

Title: Read EVM vs. Sub Carrier

Description: Triggers a new EVM vs. Sub Carrier measurement and returns the results: EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID. The EVM vs. Sub Carrier measurement must be the active measurement (specified by :CONFigure:DEMod EVSCarrier). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:FETCh:DEMod:EVSCarrier?`
`:CONFigure:DEMod EVSCarrier`

:READ:DEMod:EVSYmbol?

Title: Read EVM vs. Symbol

Description: Triggers a new EVM vs. Symbol measurement and returns the results: EVM (rms), EVM (pk), RCE (rms), RCE (pk), Carrier Frequency, Freq Error, Freq Error, and the Base Station ID The EVM vs. Symbol measurement must be the active measurement (specified by :CONFigure:DEMod EVSYmbol). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, RCE (rms) in dB, RCE (pk) in dB, Carrier Frequency in MHz, Freq Error in MHz, Freq Error in ppm, and the Base Station ID.

Related Command: `:FETCh:DEMod:EVSYmbol?`
`:CONFigure:DEMod EVSYmbol`

:READ:DEMod:SFLatness?

Title: Read Spectral Flatness

Description: Triggers a new Spectral Flatness measurement and returns the absolute delta of the power between adjacent sub carriers in dB. The Spectral Flatness measurement must be the active measurement (specified by :CONFigure:DEMod SFLatness). The current measurement can be queried using the command :CONFigure?

Related Command: `:FETCh:DEMod:SFLatness?`
`:CONFigure:DEMod SFLatness`

:READ:PFail?

Title: Read PASS/FAIL

Description: Triggers a new PASS/FAIL measurement and returns the results. It is a combination of the commands :ABORT; :INITiate; :FETCh:PFail? The PASS/FAIL measurement must be active. The current measurement can be queried using :CONFigure?

Related Command: `:FETCh:PFail?`
`:CONFigure PFail`
`:MEASure:PFail?`

Front Panel Access: Measurements, Pass/Fail Mode

:READ:RF:ACPR?

Title: Read Adjacent Channel Power Ratio

Description: Triggers a new Adjacent Channel Power Ratio measurement and returns the results: Power levels for each channel (both absolute and relative). It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:ACPR? The ACPR measurement must be the active measurement (specified by :CONFigure:RF ACPR). The current measurement can be queried using :CONFigure?

Data is returned as 11 comma-delimited values: The Channel Power in dBm, relative adjacent channel 1 power level, absolute adjacent channel 1 power level, relative adjacent channel 2 power level, absolute adjacent channel 2 power level, relative adjacent channel 3 power level, absolute adjacent channel 3 power level, relative adjacent channel 4 power level, absolute adjacent channel 4 power level, relative adjacent channel 5 power level, absolute adjacent channel 5 power level. The relative adjacent channel power level is in dB and the absolute adjacent channel power level is in dBm.

Related Command: `:FETCh:RF:ACPR?`
`:CONFigure:RF ACPR`
`:MEASure:RF:ACPR?`

:READ:RF:PVTime?

Title: Read Power vs. Time

Description: Triggers a new Power vs. Time measurement and returns the results: Channel Power, Preamble power, burst power of data bursts, and the Crest Factor. It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:PVTime? The Power vs. Time measurement must be the active measurement (specified by :CONFigure:RF PVTime). The current measurement can be queried using :CONFigure?

Data is returned as 4 comma-delimited values: The Channel Power in dBm, Preamble power in dBm, burst power of data bursts in dBm, and the Crest Factor in dB.

Related Command: `:FETCh:RF:PVTime?`
`:CONFigure:RF PVTime`

:READ:RF:SPECtrum?

Title: Read RF Spectrum

Description: Triggers a new RF Spectrum measurement and returns the results: Channel Power (RSSI) and Occupied bandwidth measurement. It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:SPECtrum? The Spectrum measurement must be the active measurement (specified by :CONFigure:RF SPECtrum). The current measurement can be queried using :CONFigure?

Data is returned as 2 comma-delimited values: Channel Power(RSSI) in dBm and Occupied bandwidth measurement in MHz.

Related Command: `:FETCh:RF:SPECtrum?`
`:CONFigure:RF SPECtrum`
`:MEASure:RF:SPECtrum?`

8-10 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble? <trace type>

Title: Trace Header Transfer

Description: Returns trace header information for the specified trace. The <trace type> must be one of the following:
SPECtrum|PVTime|ACPR|CONStln|SFLatness|EVSCarrier|EVSYmbol

Data can be transferred to and from the 7 available display trace types. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It looks like #AX, where A is the number of digits in X and X is the number of bytes that follow the header. Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "NAME=VALUE[UNITS]," Valid parameter names are shown inTable 7-1, "Available Parameters in WiMAX and Mobile WiMAX Mode" on page 7-22.

Parameter: `<trace type>`

Related Command: `:TRACe:DATA?`

:TRACe[:DATA]? <trace type>

Title: Trace Data Transfer

Description: This command transfers trace data from the instrument to the controller. The <trace type> must be one of the following:
SPECtrum|PVTime|CONStln|SFLatness|EVSCarrier|EVSYmbol.

The format of the block data in the query form is specified by :FORMat:DATA. The block data in the command form is always sent in ASCII format. The response begins with an ASCII header that 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 that follow the header. Each data point is separated by a comma delimiter. Trace setup information can be acquired using :TRACe[:DATA]:PREamble?

Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. Except for CONStln there is only one value per data point. If max hold is set to ON for SPECtrum and EVM vs. Sub Carrier then the max hold value is returned. For CONStln, each data point is represented by 3 values 4 bytes each: IData (no units), QData (no units), and the constellation type (no units). For SPECtrum and PVTime unit is in dBm. For Spectral Flatness unit is in dB. For EVM vs Sub Carrier and EVM vs Symbol unit is in percent. Note that the instrument must be set in the selected view. Use the CONFigure command to set the unit to the selected view.

Parameter: `<trace type>`

Related Command: `:FORMat[:DATA]`
`:TRACe[:DATA]:PREamble?`

8-11 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:BANDwidth|BWIDth[:RESolution] <index>
[:SENSe]:BANDwidth|BWIDth[:RESolution]?

Title: Resolution Bandwidth

Description: Sets the resolution bandwidth. The <index> argument is a 1-based index of the position of the desired bandwidth in the instrument's current bandwidth list. The list can be displayed on the instrument by choosing the "BW" submenu button in the "Setup" menu. For example, if the desired bandwidth is the 3rd item on the list then the value of the <index> argument would be 3.

The query form of this command will return the index of the currently selected bandwidth on the list. The Default is the 1st index in the bandwidth list.

Parameter: <index>

Default Value: The default bandwidth is 5 MHz which is the 1st index in the bandwidth list.

Front Panel Access: Setup, BW

[:SENSe]:DEMod:CONStln:REFPoints[:STATe] OFF|ON|0|1
[:SENSe]:DEMod:CONStln:REFPoints[:STATe]?

Title: Constellation Reference Points

Required Option: 47

Description: Sets the display of the reference points for the various constellations on/off.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: ON

Front Panel Access: **Measurements**, Demodulator, Constellation, Reference Points

[:SENSe]:FREQuency:CENTer <freq>
[:SENSe]:FREQuency:CENTer?

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.

Parameter: `<freq>`

Default Value: 2.5 GHz

Default Unit: Hz

Range: 0 Hz to 7.1 GHz

Front Panel Access: **Freq**, Center Freq

[:SENSe]:FREQuency:SIGStandard:CHANnel <number>
[:SENSe]:FREQuency:SIGStandard:CHANnel?

Title: Channel Selection

Description: Sets the channel number for the selected signal standard.

Parameter: `<number>`

Front Panel Access: **Freq**, Channel

[:SENSe]:FREQuency:SIGStandard:NAMe <string>
[:SENSe]:FREQuency:SIGStandard:NAMe?

Title: Signal Standard

Description: Selects the desired signal standard from the list. The <string> argument is the name of the desired signal standard as displayed in the instrument's current signal standard list. The list can be displayed on the instrument by choosing the Signal Standard submenu button in the Freq menu. The list can also be downloaded remotely and viewed using Anritsu Master Software Tools. For example, if the desired Signal Standard is P-GSM 900 - Uplink then the value of the <string> argument would be "P-GSM 900 - Uplink".

The query form of this command will return the name of the currently selected Signal Standard on the list.

Parameter: <string>

Front Panel Access: **Freq**, Signal Standard

[:SENSe]:PFail <test set>
[:SENSe]:PFail?

Title: PASS/FAIL Test Selection

Description: Selects the active test set to be used in subsequent PASS/FAIL measurements. The <test set> value must correspond to a test set that is defined in the test set list. To view the list on the instrument, go into the “Measurement” menu, press the “Pass/Fail Mode” key, and then press the “Select Pass/Fail Test” submenu. Alternatively, the list can be retrieved remotely and viewed using the Anritsu Master Software Tools. The <test set> argument is a 1-based index of the position of the desired Pass/Fail test set in the instrument’s current Pass/Fail test set list. For example, if the desired Pass/Fail test is the 3rd item on the list then the value of the <test set> argument would be 3.

When using the query form of the command, the return value is the currently selected test set number. If there is not a valid test set selected, the return value is “-1” (negative 1).

Parameter: `<test set>`

Related Command: `:CONFigure PFail`

Front Panel Access: **Measurements**, Pass/Fail Mode, Select Pass/Fail Test

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Title: Automatic Amplitude Range

Description: Sets the automatic amplitude range. Setting the value to ON or 1 will result in the amplitude range being coupled to the detected input signal level. Setting the value to OFF or 0 will result in the input attenuation being un-coupled from the input signal level. That is, changing the input signal level will not change the amplitude range. When this command is issued, the amplitude range itself will not change. The default value is ON. That is, sending :SENS:POW:RANG:AUTO is equivalent to sending :SENS:POW:RANG:AUTO ON.

Parameter: `OFF|ON|0|1`

Parameter Type: <boolean>

Default Value: ON

Related Command: `:POWer[:RF]:RANGe`

Front Panel Access: **Amplitude**, Auto Range

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Title: Amplitude Range

Description: Re-calculates amplitude range. Note that issuing this command will set the automatic dynamic range OFF.

Related Command: `:POWer[:RF]:RANGe:AUTO`

Front Panel Access: **Amplitude**, Adjust Range

[:SENSe]:RF:SPECtrum:SPAN 5|10|20|30
[:SENSe]:RF:SPECtrum:SPAN?

Title: Spectrum View Span

Description: Sets the span for the Spectrum view. Setting the value to 5 will set the span for the Spectrum view to 5 MHz. Setting the value to 10 will set the span for the Spectrum view to 10 MHz. Setting the value to 20 will set the span for the Spectrum view to 20 MHz. Setting the value to 30 will set the span for the Spectrum view to 30 MHz.

Parameter: `5|10|20|30`

Default Value: 10 MHz

Default Unit: MHz

Front Panel Access: **Measurements**, RF Measurements, Spectrum, Span

Chapter 9 — LTE Commands

9-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Title: Abort

Description: Restarts the current sweep and/or measurement. 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.

Parameter: NA

9-2 :CALCulate Subsystem

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

:CALCulate:MARKer:AOFF

Title: Turn All Markers Off

Description: Turns off all markers in Channel Spectrum.

Front Panel Access: Marker, Markers Off

:CALCulate:MARKer1:DELTa:X <x1 parameter>
:CALCulate:MARKer1:DELTa:X?

Title: Delta Marker 1 X Value

Description: Sets/Queries the relative location of the delta marker from the reference marker on the x-axis.

Note: The query value might not always match the set value since the instrument will round the set value based on the display pixel resolution.

The x1 parameter is used to set the delta position.

For example, :CALC:MARK1:DELT:X 2 MHz will set the delta value to 2 MHz.

Parameter: <x1 parameter>

Default Unit: Hz

Related Command: `:CALCulate:MARKer1:X`

Front Panel Access: Marker, Marker Select (M1), Marker State (Delta), (Use arrow keys or rotary knob.)

:CALCulate:MARKer1:DELTa:Y?

Title: Delta Marker 1 Read Y Value

Description: Reads the current absolute Y value for delta marker 1.

Default Unit: dBm

:CALCulate:MARKer1:MAXimum

Title: Set Marker 1 to Peak

Description: Moves marker 1 to peak position on data trace.

Parameter: NA

Front Panel Access: Marker, Marker Select (M1), Peak Search

:CALCulate:MARKer1:STATe OFF|ON|DELta
:CALCulate:MARKer1:STATe?

Title: Set Marker 1 State

Description: Sets marker 1 on/off or delta.

Parameter: OFF|ON|DELta

Parameter Type: <char>

Default Value: OFF

Front Panel Access: Marker, Marker Select (M1), Marker State

:CALCulate:MARKer1:X <x-parameter>
:CALCulate:MARKer1:X?

Title: Set Marker 1 Value

Description: Sets/Queries the location of marker 1 on the x-axis at the specified location.

Parameter: <x-parameter>

Default Unit: Hz

Front Panel Access: Marker, Marker Select (M1), Peak Search

:CALCulate:MARKer1:Y?

Title: Marker 1 Read Y Value

Description: Reads the current Y value for marker 1.

Default Unit: dBm

:CALCulate:MARKer2:DELTa:X <x1 parameter>
:CALCulate:MARKer2:DELTa:X?

Title: Delta Marker X Value

Description: Sets/Queries the relative location of the delta marker from the reference marker on the x-axis.

Note: The query value might not always match the set value since the instrument will round the set value based on the display pixel resolution.

The x1 parameter is used to set the delta position.

For example, :CALC:MARK2:DELT:X 2 MHz will set the delta value to 2 MHz.

Parameter: <x1 parameter>

Default Unit: Hz

Related Command: `:CALCulate:MARKer2:X`

Front Panel Access: Marker, Marker Select (M2), Marker State (Delta), (Use arrow keys or rotary knob.)

:CALCulate:MARKer2:DELTa:Y?

Title: Delta Marker 2 Read Y Value

Description: Reads the current absolute Y value for delta marker 2.

Default Unit: dBm

:CALCulate:MARKer2:MAXimum

Title: Set Marker 2 to Peak

Description: Moves marker 2 to peak position on data trace.

Parameter: NA

Front Panel Access: Marker, Marker Select (M2), Peak Search

:CALCulate:MARKer2:STATe OFF|ON|DELta
:CALCulate:MARKer2:STATe?

Title: Set Marker 2 State

Description: Sets marker 2 on/off or delta.

Parameter: OFF|ON|Delta

Parameter Type: <char>

Default Value: OFF

Front Panel Access: Marker, Marker Select (M2), Marker State

:CALCulate:MARKer2:X <x-parameter>
:CALCulate:MARKer2:X?

Title: Set Marker 2 Value

Description: Sets/Queries the location of marker 2 on the x-axis at the specified location.

Parameter: <x-parameter>

Default Unit: Hz

Front Panel Access: Marker, Marker Select (M2), Peak Search

:CALCulate:MARKer2:Y?

Title: Marker2 Read Y Value

Description: Reads the current Y value for marker 2.

Default Unit: dBm

9-3 :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?

Title: Configure Query

Description: :CONFigure? query returns the name of the measurement previously set up using a CONFigure command or a MEASure? query. The list below shows the possible return values.

CAGG
SUMM
RF,SPEC
RF,ACLR
RF,SEM
RF,SUMM
DEM,CONS
DEM,CCPG
DEM,CCPT
DEM,SUMM
PF
OTA
OTA,OTAS

:CONFigure:DEMod SUMMary|CONStln|CCPGraph|CCPTable|TIMEalign

Title: Select the Modulation Measurement

Description: Sets measurement to one of the Modulation screens. This can be one of:

SUMMary: Modulation Summary view
CONStln: Modulation Constellation diagram
CCPGraph: Control Channel Power - Bar-graph view
CCPTable: Control Channel Power - Table view
TIMEalign: Tx Time Alignment

It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe] commands before initiating a measurement.

Parameter: SUMMary | CONStln | CCPGraph | CCPTable | TIMEalign

Parameter Type: <char>

Front Panel Access: Measurements, Modulation, (Constellation, Control Channel Power, Tx Time Alignment, Modulation Summary). If Control Channel Power is selected, press Control Channel Power again, then press Display Mode to select Bar Graph or Table.

:CONFigure:OTA SCANner|TXTEst|MAPping|CAGGregation

Title: Configure Over-the-Air Measurement

Description: Sets the measurement to one of the Over-the-Air screens. This can be one of:

SCANner: Scanner measurement view
TXTEst: Tx Test measurement view
MAPping: Coverage Mapping measurement view
CAGGregation: Carrier Aggregation measurement view

Parameter: SCANner | TXTEst | MAPping | CAGGregation

Parameter Type: <char>

Front Panel Access: Measurements, Over-the-Air, (Scanner, Tx Test, Mapping, Carrier Aggregation)

:CONFigure:RF SUMMary|SPECtrum|ACLR|SEM

Title: Select RF Measurements

Description: This command configures RF measurements. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. Sets the instrument to single sweep mode (:INITiate:CONTinuous OFF).Measurement settings can be modified by using the [:SENSe] commands before initiating a measurement.

Set measurement to one of the RF measurement screens. This can be one of:

SUMMary: RF measurement summary screen.

SPECtrum: RF Channel Spectrum measurement screen.

ACLR: ACLR measurement view.

SEM: Spectral Emission Mask measurement.

Parameter: SUMMary|SPECtrum|ACLR|SEM

Front Panel Access: Measurements, RF, (Channel Spectrum, ACLR, Spectral Emission Mask, RF Summary)

:CONFigure SUMMary

Title: Set Measurement to LTE Summary

Description: Sets the measurement to LTE Summary. It disables any other active measurements. None of the instrument parameters are changed by the execution of this command. (:INITiate:CONTinuous OFF). Measurement settings can be modified by using the [:SENSe] commands before initiating a measurement.

Parameter: SUMMary

Parameter Type: <char>

Front Panel Access: Measurements, LTE Summary

9-4 :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:WINDow:TRACe:Y[:SCALe]:OFFSet <rel ampl>
:DISPlay:WINDow:TRACe:Y[:SCALe]:OFFSet?

Title:	Power Offset
Description:	Sets the power offset value for the y-axis.
Parameter:	<rel ampl>
Default Value:	0 dB
Default Unit:	dB
Range:	–100 dB to +100 dB
Front Panel Access:	Amplitude, Power Offset

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <rel ampl>
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Title:	Scale
Description:	Sets the Scale/Division setting for the y-axis. This only affects the scale for the Channel Spectrum measurement.
Parameter:	<rel ampl>
Default Value:	10 dB/div
Default Unit:	dB
Range:	1 dB to 15 dB
Front Panel Access:	Amplitude, Scale

9-5 :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:DEMod:4x4:TIMEalign?

Title: Fetch Tx Time Alignment Data (4x4 MIMO configuration)

Description: Returns the most recent Time Alignment measurement numeric results. This command may not be supported if your instrument is loaded with older firmware, in which case you may upgrade to the current firmware version or use the :FETCh:DEMod:TIMEalign? command, instead. Refer to your instrument User Guide for instructions on updating firmware.

Data is returned as 14 comma-delimited values: EVM (rms) in %, EVM (pk) in %, Ref Signal (RS) Power in dBm, Sync Signal (SS) Power in dBm, Carrier Frequency in MHz, Freq Error in Hz, Freq Error in ppm, Cell ID, and Time Alignment Error (TAE) in nanoseconds for each of antenna pairs 1-2, 1-3, 1-4, 2-3, 2-4, and 3-4. “--” is returned for each data that is not valid at that instance.

Front Panel Access: Measurements, Modulation, Tx Time Alignment

:FETCh:DEMod:CCPData?

Title: Fetch Control Power Data

Description: Returns the most recent Control Channel Power measurement numeric results.

Data is returned as 24 comma-delimited values: RS_POWER, PSS_POWER, SSS_POWER, BCH_POWER, CFI_POWER, RS_TOTAL_POWER, PSS_TOTAL_POWER, SSS_TOTAL_POWER, BCH_TOTAL_POWER, CFI_TOTAL_POWER, TOTAL_POWER, TOTAL_CHANNEL_POWER

Front Panel Access: Measurements, Modulation, Control Channel Power

:FETCh:DEMod:CONStln?

Title: Fetch Constellation

Description: Returns the constellation measurement numeric results of the demodulated data symbol over one sub-frame measurement. Data is returned as 8 comma-delimited values:
EVM (rms) in %, EVM (pk) in %, Ref Signal (RS) Power in dBm, Sync Signal (SS) Power in dBm,Carrier Frequency in MHz, Freq Error in Hz, Freq Error in ppm, and the Cell ID. “--” is returned for each data that is not valid at that instance.

Front Panel Access: Measurements, Modulation, Constellation

:FETCh:OTA:C4AGGregation?

Title: Fetch OTA Carrier Aggregation (4x4 MIMO configuration)

Description: Returns the result of the most recent Carrier Aggregation measurement numeric results. This command may not be supported if your instrument is loaded with older firmware, in which case you may upgrade to the current firmware version or use the :FETCh:OTA:CAGGregation? command, instead. Refer to your instrument User Guide for instructions on updating firmware.

Data is returned as 70 comma delimited values. The values consist of 5 sets of Component Carrier (CC) data, with each set containing 14 fields (CP, tx1 antenna, tx2 antenna, tx3 antenna, tx4 antenna, RS Power, RS Delta Power, SS Power, EVM(rms), EVM(pk), Freq Error, Freq Error (ppm), TAE (nS), and Cell ID). The data is in sequential CC order. A field with "--" means the data was invalid. An inactive Component Carrier will show N/A for the entire set of data.

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation

:FETCh:OTA:CAGGregation?

Title: Fetch OTA Carrier Aggregation

Description: Returns the result of the most recent Carrier Aggregation measurement numeric results. Data is returned as 60 comma delimited values. The values consist of 5 sets of Component Carrier (CC) data with each set containing 12 fields (CP, tx1 antenna, tx2 antenna, RS Power, RS Delta Power, SS Power, EVM(rms), EVM(PK), Freq Error, Freq Error (ppm), TAE (nS), and Cell ID). The data is in sequential CC order. A field with "--" means the data was invalid. An inactive Component Carrier will show N/A for the entire set of data.

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation, CC#

:FETCh:RF:ACLR?

Title: Fetch Adjacent Channel Leakage Ratio

Description: Returns the most recent adjacent channel leakage ratio measurement results. If the instrument is sweeping, it will not return until the sweep is complete. Refer to ":READ:RF:ACLR?" on page 9-19 for a description of the returned data.

Default Unit: dBm

Front Panel Access: Measurements, RF, ACLR

:FETCh:RF:SEM?

Title: Fetch Spectral Emission Mask

Description: Returns Spectral Emission Mask measurement results (Pass or Fail).

Front Panel Access: Measurements, RF, Spectral Emission Mask

:FETCh:RF:SPECtrum?

Title: Fetch RF Spectrum

Description: Returns the most recent RF Spectrum measurement results. Data is returned as 2 comma-delimited values: Channel Power in dBm and Occupied bandwidth measurement in MHz. "--" is returned for each data that is not valid at that instance.

Front Panel Access: Measurements, RF, Channel Spectrum

:FETCh:SUMMary?

Title: Fetch Summary

Description: Returns the values displayed in a Summary measurement view. If the current display
is not a summary screen, then the return value is 'N/A'. The return value is a comma separated list of the values displayed on the screen, in the order they are displayed
from top to bottom. The list is preceded by the name of the summary view; either
"LTE Summary", "RF Summary" or "Modulation Summary".

9-6 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Title: Numeric Data Format

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units. This format requires many more bytes so it is the slowest format. INTeger values are signed 32-bit integers in little-endian byte order. This format returns the data in 4-byte blocks. REAL 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 instrument units. Both INTeger and REAL formats return a definite block length. Each transfer begins with an ASCII header such as #42204. The first digit represents the number of following digits in the header (in this example, 4). The remainder of the header indicates the number of bytes that follow the header (in this example, 2204). You then divide the number of following bytes by the number of bytes in the data format you've chosen (4 for both INTeger and REAL) to get the number of data points (in this example, 551).

Parameter: ASCii|INTeger,32|REAL,32

Parameter Type: <char>

Default Value: ASCii

9-7 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Title: Continuous/Single Sweep

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 enters the “idle” state and waits for the :INITiate[:IMMediate] command or for :INITiate:CONTinuous ON. 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. Note that rapid toggling between ON and OFF is not allowed. The instrument must be allowed to make a full sweep before toggling can be done.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: ON

Related Command: `:INITiate[:IMMediate]`

Front Panel Access: Shift-3 (Sweep), Sweep

:INITiate[:IMMediate]

Title: Trigger Sweep/Measurement

Description: Initiates a sweep/measurement. If :INITiate:CONTinuous is set to ON, this command is ignored. Use this command in combination with :STATus:OPERation? 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.

Related Command: `:INITiate:CONTinuous`
`:STATus:OPERation?`

Front Panel Access: Shift-3 (Sweep), Sweep (Single), Trigger Sweep

9-8 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:DEMod:4x4:TIMEalign?

Title: Measure Tx Time Alignment Data (4x4 MIMO configuration)

Description: Sets the active measurement to Tx Time Alignment, sets the default measurement parameters, triggers a new measurement, and returns the measured values. This command may not be supported if your instrument is loaded with older firmware, in which case you may upgrade to the current firmware version or use the :MEASure:DEMod:TIMEalign? command, instead. Refer to your instrument User Guide for instructions on updating firmware.

Data is returned as 14 comma-delimited values: EVM (rms) in %, EVM (pk) in %, Ref Signal (RS) Power in dBm, Sync Signal (SS) Power in dBm, Carrier Frequency in MHz, Freq Error in Hz, Freq Error in ppm, Cell ID, and Time Alignment Error (TAE) in nanoseconds for each of antenna pairs 1-2, 1-3, 1-4, 2-3, 2-4, and 3-4. "--" is returned for each data that is not valid at that instance.

Front Panel Access: Measurements, Modulation, Tx Time Alignment

:MEASure:DEMod:CCPData?

Title: Read Modulation Control Channel Power Data

Description: Sets the active measurement to Control Channel Power, sets the default measurement parameters, triggers a new measurement, and returns the measured values: RS_POWER, PSS_POWER, SSS_POWER, BCH_POWER, CFI_POWER, RS_TOTAL_POWER, PSS_TOTAL_POWER, SSS_TOTAL_POWER, BCH_TOTAL_POWER, CFI_TOTAL_POWER, TOTAL_POWER, TOTAL_CHANNEL_POWER. Data returned is the same for Bar Graph or Table mode. The Control Channel Power measurement must be the active measurement.

Front Panel Access: Measurements, Modulation, Control Channel Power

:MEASure:DEMod:CONStln?

Title: Measure Constellation

Description: Triggers a new Constellation measurement and returns the results. The Constellation measurement must be the active measurement (specified by :CONFigure:DEMod CONStln). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, Ref Signal (RS) Power in dBm, Sync Signal (SS) Power in dBm, Carrier Frequency in MHz, Freq Error in Hz, Freq Error in ppm, and the Cell ID. "--" is returned for each data that is not valid at that instance.

Front Panel Access: Measurements, Modulation, Constellation

:MEASure:OTA:C4AGGregation?

Title: Measure OTA Carrier Aggregation (4x4 MIMO configuration)

Description: Sets the active measurement to Carrier Aggregation, triggers a new measurement, and returns the measured values. This command may not be supported if your instrument is loaded with older firmware, in which case you may upgrade to the current firmware version or use the :MEASure:OTA:CAGGregation? command, instead. Refer to your instrument User Guide for instructions on updating firmware.

Data is returned as 70 comma delimited values. The values consist of 5 sets of Component Carrier (CC) data, with each set containing 14 fields (CP, tx1 antenna, tx2 antenna, tx3 antenna, tx4 antenna, RS Power, RS Delta Power, SS Power, EVM(rms), EVM(pk), Freq Error, Freq Error (ppm), TAE (nS), and Cell ID). The data is in sequential CC order. A field with "--" means the data was invalid. An inactive Component Carrier will show N/A for the entire set of data.

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation

:MEASure:OTA:CAGGregation?

Title: Measure OTA Carrier Aggregation

Description: Sets the active measurement to Carrier Aggregation, triggers a new measurement, and returns the measured values.

Data is returned as 60 comma delimited values. The values consist of 5 sets of Component Carrier (CC) data with each set containing 12 fields (CP, tx1 antenna, tx2 antenna, RS Power, RS Delta Power, SS Power, EVM(rms), EVM(PK), Freq Error, Freq Error (ppm), TAE (nS), and Cell ID). The data is in sequential CC order. A field with "--" means the data was invalid. An inactive Component Carrier will show N/A for the entire set of data.

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation

:MEASure:RF:ACLR?

Title: Measure Adjacent Channel Leakage 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(s) power, and adjacent channel(s) power. It is a combination of the commands :CONFigure:RF ACLR and :READ:RF:ACLR? Refer to ":READ:RF:ACLR?" on page 9-19 for a description of the returned data.

Default Unit: dBm

Front Panel Access: Measurements, RF, ACLR

:MEASure:RF:SEM?

Title: Measure Spectral Emission Mask

Description: Sets the active measurement to Spectral Emission Mask and returns a PASS or FAIL result.

Front Panel Access: Measurements, RF, Spectral Emission Mask

:MEASure:RF:SPECtrum?

Title: Measure RF Spectrum

Description: Sets the active measurement to Channel Spectrum, sets the default measurement parameters, triggers a new measurement and returns the Channel Power and Occupied Bandwidth measurement results. It is a combination of the following command :CONFigure:RF SPECtrum and :READ:RF:SPECtrum? Data is returned as 2 comma-delimited values: Channel Power in dBm and Occupied bandwidth in MHz.

Front Panel Access: Measurements, RF, Channel Spectrum

9-9 :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:DEMod:4x4:TIMEalign?

Title: Read Tx Time Alignment Data (4x4 MIMO configuration)

Description: Triggers a new Time Alignment measurement and returns the results. The Tx Time Alignment measurement must be the active measurement (specified by :CONFigure:DEMod TIMEalign). The current measurement can be queried using the command :CONFigure?

This command may not be supported if your instrument is loaded with older firmware, in which case you may upgrade to the current firmware version or use the :READ:DEMod:TIMEalign? command, instead. Refer to your instrument User Guide for instructions on updating firmware.

Data is returned as 14 comma-delimited values: EVM (rms) in %, EVM (pk) in %, Ref Signal (RS) Power in dBm, Sync Signal (SS) Power in dBm, Carrier Frequency in MHz, Freq Error in Hz, Freq Error in ppm, Cell ID, and Time Alignment Error (TAE) in nanoseconds for each of antenna pairs 1-2, 1-3, 1-4, 2-3, 2-4, and 3-4. “--” is returned for each data that is not valid at that instance.

Front Panel Access: Measurements, Modulation, Tx Time Alignment

:READ:DEMod:CONStln?

Title: Read Constellation

Description: Triggers a new Constellation measurement and returns the results. The Constellation measurement must be the active measurement (specified by :CONFigure:DEMod CONStln). The current measurement can be queried using the command :CONFigure?

Data is returned as 8 comma-delimited values: EVM (rms) in %, EVM (pk) in %, Ref Signal (RS) Power in dBm, Sync Signal (SS) Power in dBm, Carrier Frequency in MHz, Freq Error in Hz, Freq Error in ppm, and the Cell ID. “--” is returned for each data that is not valid at that instance.

Front Panel Access: Measurements, Modulation, Constellation

:READ:OTA:C4AGGregation?

Title: Read OTA Carrier Aggregation (4x4 MIMO configuration)

Description: Triggers a new Carrier Aggregation measurement and returns the results. OTA Carrier Aggregation must be the active measurement. This command may not be supported if your instrument is loaded with older firmware, in which case you may upgrade to the current firmware version or use the :READ:OTA:CAGGregation? command, instead. Refer to your instrument User Guide for instructions on updating firmware.

Data is returned as 70 comma delimited values. The values consist of 5 sets of Component Carrier (CC) data, with each set containing 14 fields (CP, tx1 antenna, tx2 antenna, tx3 antenna, tx4 antenna, RS Power, RS Delta Power, SS Power, EVM(rms), EVM(pk), Freq Error, Freq Error (ppm), TAE (nS), and Cell ID). The data is in sequential CC order. A field with "--" means the data was invalid. An inactive Component Carrier will show N/A for the entire set of data.

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation

:READ:OTA:CAGGregation?

Title: Read OTA Carrier Aggregation

Description: Triggers a new Carrier Aggregation measurement and returns the results. The Carrier Aggregation measurement must be the active measurement (specified by :CONFigure:DEMod CAGGregation). The current measurement can be queried using the command :CONFigure?

Data is returned as 60 comma delimited values. The values consist of 5 sets of Component Carrier (CC) data with each set containing 12 fields (CP, tx1 antenna, tx2 antenna, RS Power, RS Delta Power, SS Power, EVM(rms), EVM(PK), Freq Error, Freq Error (ppm), TAE (nS), and Cell ID). The data is in sequential CC order. A field with "--" means the data was invalid. An inactive Component Carrier will show N/A for the entire set of data.

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation

:READ:PFail?

Title: Read PASS/FAIL

Description: Triggers a new PASS/FAIL measurement and returns the results. It is a combination of the commands :ABORT; :INITiate; :FETCh:PFail? The PASS/FAIL measurement must be active. The current measurement can be queried using :CONFigure?

Related Command:
```
MEASure:PFail?
:CONFigure PFail
FETCh:PFail?
:CONFigure PFail
```

Front Panel Access: Measurements, Pass/Fail Test

:READ:RF:ACLR?

Title: Read Adjacent Channel Leakage Ratio

Description: Triggers a new Adjacent Channel Leakage Ratio measurement and returns the results: Power levels for each channel (both absolute and relative). 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 11 comma-separated values: Main channel power, Left alternate channel power - relative, absolute , Left adjacent channel power - relative, absolute,
Main channel power - relative,absolute, Right adjacent channel power - relative, absolute, Right Alternate channel power - relative, absolute.

Default Unit: dBm

Front Panel Access: Measurements, RF, ACLR

:READ:RF:SEM?

Title: Read RF Spectral Emmision Mask

Description: Triggers a new RF Spectral Emission Mask measurement and returns a PASS or FAIL result. It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:SEM?
The current measurement can be queried using :CONFigure?

Front Panel Access: Measurements, RF, Spectral Emission Mask

:READ:RF:SPECtrum?

Title: Read RF Spectrum

Description: Triggers a new RF Spectrum measurement and returns the results: Channel Power and Occupied BW measurement. It is a combination of the commands :ABORT; :INITiate; :FETCh:RF:SPECtrum? The current measurement can be queried using :CONFigure?

Data is returned as 2 comma-delimited values: Channel Power in dBm and Occupied bandwidth measurement in MHz.

Related Command: `:FETCh:RF:SPECtrum?`
`:CONFigure:RF SPECtrum`
`:MEASure:RF:SPECtrum?`

Front Panel Access: Measurements, RF, Channel Spectrum

9-10 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer DBM|W
:UNIT:POWer?

Title:	Measurement Units
Description:	Sets/Returns the current display mode for power values as either dBm or in watts.
Parameter:	DBM|W
Parameter Type:	<char>
Default Value:	dBm
Front Panel Access:	Amplitude, Units

9-11 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:4TAE:ACTive OFF|ON
[:SENSe]:4TAE:ACTive?

Title: Time Alignment Error (4x4 MIMO configuration)

Description: Sets the state of the TAE measurement for OTA carrier aggregation. In 2x2 MIMO, use the command [:SENSe]:TAE:ACTive.

Parameter: OFF|ON

Parameter Type: <boolean>

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation, TAE

[:SENSe]:BANDWidth[:RESolution] 1.4|3|5|10
[:SENSe]:BANDWidth[:RESolution]?

Title: Bandwidth Resolution

Description: Sets the channel bandwidth.

Parameter: 1.4|3|5|10

Parameter Type: <char>

Default Value: The default bandwidth is 10 MHz.

Front Panel Access: Setup, BW

[:SENSe]:CC{1|2|3|4|5}:ACTive OFF|ON
[:SENSe]:CC{1|2|3|4|5}:ACTive?

Title: Active Component Carrier

Description: Sets the specified Component Carrier (CC) to be on or off.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation, CC#, CC#

[:SENSe]:CC{1|2|3|4|5}:BANDWidth 1.4|3|5|10
[:SENSe]:CC{1|2|3|4|5}:BANDWidth?

Title: Component Carrier Bandwidth

Description: Sets the channel bandwidth of the specified Component Carrier (CC).

Parameter: 1.4|3|5|10

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation, CC#, CC#, BW

[:SENSe]:CC{1|2|3|4|5}:CHANnel <number>
[:SENSe]:CC{1|2|3|4|5}:CHANnel?

Title: Component Carrier Channel

Description: Sets the channel number for the selected signal standard for the specified Component Carrier (CC).

Parameter: `<number>`

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation, CC#, CC#, Channel

[:SENSe]:CC{1|2|3|4|5}:FREQuency <freq>
[:SENSe]:CC{1|2|3|4|5}:FREQuency?

Title: Component Carrier Frequency

Description: Sets the center frequency of the specified Component Carrier (CC).

Parameter: `<freq>`

Parameter Type: <NRf>

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation, CC#, CC#, Center Freq

[:SENSe]:CC{1|2|3|4|5}:SIGStandard <string>
[:SENSe]:CC{1|2|3|4|5}:SIGStandard?

Title: Component Carrier Signal Standard

Description: Selects the desired signal standard from the list. The <string> argument is the name of the desired signal standard as displayed in the instrument's current signal standard list. The list can be displayed on the instrument by choosing the Signal Standard submenu button in the Freq menu. The list can also be downloaded remotely and viewed using Anritsu Master Software Tools. For example, if the desired Signal Standard is P-GSM 900 - Uplink, then the value of the <string> argument would be "P-GSM 900 - Uplink".

The query form of this command returns the name of the currently selected Signal Standard from the list.

Parameter: `<string>`

Parameter Type: <char>

Front Panel Access: Measurements, Over-the-Air, Carrier Aggregation, CC#, CC#, Signal Standard

[:SENSe]:CELLID <char>
[:SENSe]:CELLID?

Title: Cell ID

Description: Sets the Cell ID value used when Sync Type is set to 'RS'.

Parameter: (the known Cell ID)

Parameter Type: <char>

Front Panel Access: Setup, Sync (RS), Cell ID

[:SENSe]:EMF:STATe OFF|ON|0|1
[:SENSe]:EMF:STATe?

Title: EMF State

Description: Switches EMF ON or OFF.

The query form of this command returns a 0 or 1 when EMF state is OFF or ON, respectively.

Note: EMF will turn ON only if the start and stop frequencies are within the frequency range of the signal analyzer and isotropic antenna used. The antenna must be connected.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Front Panel Access: Measurements, Over-the-Air, EMF

[:SENSe]:EVM:MODe AUTO|PBCHonly
[:SENSe]:EVM:MODe?

Title: Set EVM Mode

Description: Sets/Returns the EVM Mode to either Auto or PBCH Only.

Parameter: AUTO|PBCHonly

Parameter Type: <char>

Default Value: AUTO

Front Panel Access: Setup, EVM Mode

[:SENSe]:FREQuency:CENTer <freq>
[:SENSe]:FREQuency:CENTer?

Title: Center Frequency

Description: Sets the center frequency.

Parameter: <freq>

Default Value: 1 GHz

Default Unit: Hz

Range: 10 MHz to 4 GHz

Front Panel Access: Freq, Center Freq

[:SENSe]:FREQuency:SIGStandard:CHANnel <number>
[:SENSe]:FREQuency:SIGStandard:CHANnel?

Title: Channel Selection

Description: Sets the channel number for the selected signal standard.

Parameter: <number>

Front Panel Access: Frequency, Channel

[:SENSe]:FREQuency:SIGStandard:NAMe [String]
[:SENSe]:FREQuency:SIGStandard:NAMe?

Title: Signal Standard

Description: Selects the desired signal standard from the list. The <string> argument is the name of the desired signal standard as displayed in the instrument's current signal standard list. The list can be displayed on the instrument by choosing the Signal Standard submenu button in the Freq menu. The list can also be downloaded remotely and viewed using Anritsu Master Software Tools. For example, if the desired Signal Standard is P-GSM 900 - Uplink, then the value of the <string> argument would be "P-GSM 900 - Uplink".

The query form of this command will return the name of the currently selected Signal Standard from the list.

Parameter: <string>

Front Panel Access: Freq, Signal Standard

[:SENSe]:LTE:STATus?

Description: This command queries the LTE sweep complete status. Returns 1 when the sweep is complete. Returns 0 when the sweep is in progress.

Cmd Parameter: **NA**

Query Response: 0 | 1

Related Command: `:STATus:OPERation?`

Front Panel Access: **NA**

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Title: Amplitude Range

Description: Re-calculates amplitude range. Note that issuing this command will set the automatic dynamic range OFF.

Related Command: `[:SENSe]:POWer[:RF]:RANGe:AUTO`

Front Panel Access: Amplitude, Adjust Range

[:SENSe]:POWer[:RF]:RANGe:AUTO <Boolean (default=1 [ON])>
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Title: Automatic Amplitude Range

Description: Sets the automatic amplitude range. Setting the value to ON or 1 will result in the amplitude range being coupled to the detected input signal level. Setting the value to OFF or 0 will result in the input attenuation being uncoupled from the input signal level. That is, changing the input signal level will not change the amplitude range. When this command is issued, the amplitude range itself will not change. The default value is ON. That is, sending :SENS:POW:RANG:AUTO is equivalent to sending :SENS:POW:RANG:AUTO ON.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: ON

Related Command: `[:SENSe]:POWer[:RF]:RANGe`

Front Panel Access: Amplitude, Auto Range

[:SENSe]:RF:SPECtrum:SPAN Auto|1.4|3|5|10|15|20|30
[:SENSe]:RF:SPECtrum:SPAN?

Description: Sets the span for the Spectrum view. For example, setting the value to 5 will set the span for the Spectrum view to 5 MHz and setting the value to 20 will set the span for the Spectrum view to 20 MHz.

Parameter: Auto|1.4|3|5|10|15|20|30

Default Value: Auto

Default Unit: MHz

Front Panel Access: Measurements, RF, Channel Spectrum, Span

[:SENSe]:SYNC:TYPe SS|RS
[:SENSe]:SYNC:TYPe?

Title:	Set Sync Type
Description:	Sets the sync type setting.
Parameter:	SS|RS
Parameter Type:	<char>
Default Value:	SS
Front Panel Access:	Setup, Sync, Sync Type

[:SENSe]:TAE:ACTive OFF|ON
[:SENSe]:TAE:ACTive?

Title:	Time Alignment Error
Description:	Sets the state of the TAE measurement for OTA carrier aggregation.
Parameter:	OFF|ON|0|1
Parameter Type:	<boolean>
Front Panel Access:	Measurements, Over-the-Air, Carrier Aggregation, TAE

Chapter 10 — P25 Phase 1 Commands

10-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Description:	Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.
Cmd Parameters:	**NA**
Query Parameters:	**NA**
Range:	**NA**
Default Value:	**NA**
Default Unit:	**NA**
Example:	To abort a measurement: `:ABORt`
Front Panel Access:	**NA**

10-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

:CONFigure?

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `CONFigure` command or a `MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
SIGA	P25 Analyzer
COV	P25 Coverage
CONT	P25 Control
BITC	P25 Bit Capture

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:BITCap

Description: This command configures the P25 Bit Capture measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other. Please note that you must have the Rx pattern set to `VOICe` to set the P25 Bit Capture measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25 Bit Capture:

`:CONFigure:BITCap`

Related Command: `:DM:PATTern VOICe`

Front Panel Access: **Measurement**, P25 Bit Capture

:CONFigure:CONTrol

Description: This command configures the P25 Control measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other. Please note that you must have the Rx pattern set to `VOICe` or `CTRLchan` to set the P25 Control measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25 Control:

`:CONFigure:CONTrol`

Related Command: `:DM:PATTern VOICe`
`:DM:PATTern CTRLchan`

Front Panel Access: **Measurement**, P25 Control

:CONFigure:COVerage

Description: This command configures the P25 Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25 Coverage:

`:CONFigure:COVerage`

Front Panel Access: **Measurement**, P25 Coverage

:CONFigure:SIGAnalyzer

Description: This command configures the P25 Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25 Analyzer:

`:CONFigure:SIGAnalyzer`

Front Panel Access:**Measurement**, P25 Analyzer

10-3 :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[:WINDow]:TRACe:SELect?

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

`:DISPlay:TRACe:SELect?`

Front Panel Access: **Measurement**, P25 Analyzer, Active Graph

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. In the P25 Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

`:DISPlay:TRACe:Y:PDIVision 8`

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the P25 Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Unit: dBm

Example: To set the reference level to -40:

`:DISPlay:TRACe:Y:RLEVel -40`

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, BER, and Mod Fid data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|BER|MODFid`

The query version of this command returns `"RSSI"` if the mapping type is set to RSSI, `"BER"` if set to BER, and `"MODF"` if set to Mod Fid.

Please note that this command only works when the current measurement is set to P25 Coverage. Refer to the Related Command below.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|BER|MODFid

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to Mod Fid:

`:DISPlay:TRACe:FORMat:COVerage MODFid`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, P25 Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`CONStellation|SPECtrum|HISTogram|SUMMary|EYEDiagram|LINConstellation`

The query version of this command returns "CONS" if the specified trace graph type is set to Constellation, "HIST" if set to Histogram, "SPEC" if set to Spectrum, "SUMM" if set to Summary, "EYED" if set to Eye Diagram, and "LINC" if set to linear constellation.

Please note that this command only works when the current measurement is set to P25 Analyzer.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: CONStellation | SPECtrum | HISTogram | SUMMary | EYEDiagram | LINConstellation

Default Value: Trace 1: Linear Constellation
Trace 2: Spectrum
Trace 3: Histogram
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Eye Diagram:

`:DISPlay:TRACe2:FORMat:SIGAnalyzer EYEDiagram`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, P25 Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4 for P25 Analyzer. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

`:DISPlay:TRACe2:SELect`

Front Panel Access: **Measurement**, P25 Analyzer, Active Graph

10-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent P25 Coverage numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch P25 Coverage numerical data:

`:FETCh:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:FETCh:SIGAnalyzer?

Description: Returns the most recent P25 Analyzer numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
NAC (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch P25 Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

10-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to "Interpreting Returned Data" on page 10-11 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

`:FORMat INTeger,32`

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram" command on page 10-32.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. For example, *<CONSTELLATION>* is *15* bytes. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum and Histogram datapoints consists of 4 bytes.
- Eye Diagram datapoints [12 X-axis points and (12 x ((551 / Number Of Symbols) - 1)) Y-axis points] are 4 bytes each.
- Each Constellation datapoint consists of 8 bytes.
    - The first 4 bytes are the I component
    - The next 4 bytes are the Q component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

  Converting INTeger,32 Example:

  The instrument returns the following Spectrum data point in INT,32 format:

  b9 c0 fd ff

  1. Convert from little endian to big endian:

     ff fd c0 b9

  2. Since the MSb in both components is 1, they are negative numbers.
  3. The binary representation is:

     11111111111111011100000010111001

  4. Convert from two's complement (not the bits and add 1):

     100011111101000111

  5. Convert the binary values to decimal:

     147271

  6. Take out the 1e3 scale factor:

     147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:

   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

10-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

10-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to P25 Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure P25 Coverage numerical data:

`:MEASure:COVerage?`

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to P25 Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
NAC (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: The `squelch` setting `:DM:SQUelch` will blank out (--) all summary measurements on the instrument display except for Received Pwr when the received power level is lower than the squelch power setting. The received power level is also affected by the Rx Power Offset setting. The query command will still return values even if the instrument display is blanked out.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure P25 Analyzer numerical data:

`:MEASure:SIGAnalyzer?`

Front Panel Access: **NA**

10-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To recall a setup file:

```
:MMEMory:LOAD:STATe 1,"xxx.stp"
```

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use `:INSTrument:SELect` or `:INSTrument:NSELect` to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by `<filename>` should be available at the current save location. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

"`.spa`" for SPA measurement
"`.mna`" for VNA and VVM measurements
"`.hipm`" for HiPM measurements
"`.pm`" for PM measurements
"`.cwsg`" for CWSG measurements
"`.afp`" for AM/FM/PM measurements
"`.ia`" for Interference Analysis measurements
"`.cs`" for Channel Scanner measurements
"`.wmxd`" for WiMAX
"`.wmxe`" for Mobile WiMAX
"`.lte`" for LTE measurements
"`.p25`" for P25 measurements
"`.p252`" for P25p2 measurements
"`.nxdn`" for NXDN measurements
"`.dpmr`" for dPMR measurements
"`.dmr2`" for DMR 2 measurements
"`.ptc`" for PTC measurements
"`.tetra`" for TETRA measurements
"`.nbfm`" for NBFM measurements

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

```
:MMEMory:LOAD:TRACe 1,"xxx.p25"
```

Front Panel Access: **Shift 7** (File), Recall Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be recalled on the instrument.

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: `<integer>`,`<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a setup file:

`:MMEMory:STORe:STATe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: `<integer>`,`<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a measurement file:

`:MMEMory:STORe:TRACe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be saved on the instrument.

10-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new P25 Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT`; `:INITiate`; `:FETCh:COVerage?` P25 Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read P25 Coverage numerical data:

`:READ:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new P25 Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT; :INITiate; :FETCh:SIGAnalyzer?`

P25 Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?` Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
NAC (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read P25 Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

10-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the P25 signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

```
:SOURce:CORRection:OFFSet -10
```

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

```
:SOURce:DM:PATTern 2
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format and patterns:

0: p25_1011
1: p25_511(O.153)
2: p25_1011_cal
3: p25_intfr
4: p25_silence
5: p25_busy
6: p25_idle
7: p25_high_dev
8: p25_low_dev
9: p25_fidelity
10: cw
11: am_1khz_audio
12: fm_1khz_audio

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

```
:SOURce:DM:PATTern:LIST?
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

```
:SOURce:FREQuency:CENTer 145000000
```

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the P25 signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or
70710678 fV to 223606797749978 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

`:SOURce:POWer -10`

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

`:SOURce:STATe ON`

Front Panel Access: **Turn Sig-Gen ON/OFF**

10-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the `MMEMory` subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as `"NAME=VALUE[UNITS]"`. Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 10-1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To get the trace preamble:

`:TRACe:PREamble?`

Front Panel Access: **NA**

Table 10-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.

Table 10-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style)..
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.

Table 10-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.

Table 10-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).

Table 10-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 10-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).

Table 10-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Not used.
SYSTEM_ID	Not used.
COLOR_CODE	Not used.

:TRACe[:DATA]? ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by `:FORMat:DATA`. Trace setup information can be acquired using `:TRACe[:DATA]:PREamble?` Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
<CONSTELLATION>	</CONSTELLATION>
<HISTOGRAM>	</HISTOGRAM>
<SPECTRUM>	</SPECTRUM>
<EYE_DIAGRAM>	</EYE_DIAGRAM>

The tags listed above will always show up in the response and will always be in the order described.

Constellation data will have two elements per point. There will be 551 constellation points total.

Spectrum and histogram data will only have one element per point. There will also only be 551 points per trace.

Eye diagram will have 12 X-axis points followed by (12 x ((551 / Number Of Symbols) - 1)) Y-axis points.

Each eye line will consist of 12 Y-axis points combined with the X-axis points that are sent at the beginning.

Please note that this command only works in the P25 Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: `ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram`

Range: ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

`:TRACe? SPECtrum`

Front Panel Access: **NA**

10-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description: Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the P25 Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm. If the unit is set to Watts, the P25 Signal Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the P25 Signal Analyzer received power and squelch setting will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the receiver units to watts:

```
:UNIT:POWer:RX WATT
```

Front Panel Access: **Amplitude**, Units, Rx Units

:UNIT:POWer:TX DBM|WATT|VOLTs
:UNIT:POWer:TX?

Description: Sets the generator unit to dBm or Watts or Volts. If the unit is set to dBm, the Tx Output Lvl setting will be set and queried in dBm. If the unit is set to Watts, the Tx Output Lvl setting will be set and queried in fW. If the unit is set to Volts, the Tx Output Lvl will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the generator units to volts:

```
:UNIT:POWer:TX VOLT
```

Front Panel Access: **Amplitude**, Units, Tx Units

10-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:APPLication:TST?

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

`:APPLication:TST?`

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. `[:SENSe]:APPLication:TST?` must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 show the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 14 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

`:APPLication:TST?;:APPLication:TST:RESult?`

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:AVERage:COUNt <integer>
[:SENSe]:AVERage:COUNt?

Description:	Sets the number of times the numerical values in the P25 Analyzer Summary window are averaged. Please note that NAC is not averaged.
Cmd Parameters:	<integer>
Query Parameters:	**NA**
Range:	1 to 25
Default Value:	1
Default Unit:	**NA**
Example:	To set averaging to 15: `:AVERage:COUNt 15`
Front Panel Access:	**Setup**, Averaging

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description:	Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm. If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted. The Received Pwr value in the Summary Table is also affected by changing this value. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.
Cmd Parameters:	`<value>`
Query Parameters:	**NA**
Range:	100 dB Ext Loss to 100 dB Ext Gain
Default Value:	0 dB
Default Unit:	dB
Example:	To set the external attenuation to 30 dB: `:CORRection:OFFSet 30`
Front Panel Access:	**Amplitude**, Rx Power Offset

[:SENSe]:DM:SQUelch <value>
[:SENSe]:DM:SQUelch?

Description: Sets the squelch power level. The squelch is only applied to the P25 Analyzer Summary window on the front panel and will blank out (--) all summary measurements except for Received Pwr when the received power level is lower than the squelch power setting. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: NA

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW or 223.6 mV to 223.61 nV

Default Value: -100 dBm or 100 fW or 2.24 µV

Default Unit: dBm or fW or fV

Example: To set the squelch to -10 dBm:

```
:DM:SQUelch -10
```

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:DM:FORMat C4FM|CQPSk
[:SENSe]:DM:FORMat?

Description: Sets the modulation type. Please note that setting the modulation type will restart the sweep.

Cmd Parameters: `C4FM|CQPSk`

Query Parameters: **NA**

Range: C4FM|CQPSK

Default Value: C4FM

Default Unit: **NA**

Example: To set the modulation type to CQPSK:

```
:DM:FORMat CQPSk
```

Front Panel Access: **Setup**, Mod Type

[:SENSe]:DM:PATTern 1011hz|O.153|VOICe|CTRLchan
[:SENSe]:DM:PATTern?

Description: Sets the receiver pattern type. Please note that setting the Rx Pattern will restart the sweep.

Cmd Parameters: `1011hz|O.153|VOICe|CTRLchan`

Query Parameters: **NA**

Range: 1011hz|O.153|VOICe|CTRLchan

Default Value: 1011hz

Default Unit: **NA**

Example: To set the modulation type to voice:

`:DM:PATTern VOICe`

Front Panel Access: **Setup**, Rx Pattern

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

`:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:COUPling OFF|ON|0|1
[:SENSe]:FREQuency:COUPling?

Description: Turns on frequency coupling. When frequency coupling is on, the Tx frequency cannot be set directly. The Rx Frequency and coupling offset must be used to set the desired Tx frequency. The Tx frequency will automatically trail the Rx frequency by the frequency coupling offset every time the Rx frequency is set. Please note that turning on frequency coupling will automatically move the Tx frequency to the Rx frequency plus any frequency coupling offset. If the Rx frequency and frequency coupling offset is at a setting where the Tx frequency will be beyond the min/max limits, the instrument will not allow coupling to be turned on. The query command returns the state of the frequency coupling setting. A return value of 1 is ON, and a return value of 0 is OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn Rx/Tx frequency coupling on:

`:SENSe:FREQuency:COUPling ON`

Front Panel Access: **Frequency**, Rx/Tx Coupling

[:SENSe]:FREQuency:COUPling:OFFSet <value>
[:SENSe]:FREQuency:COUPling:OFFSet?

Description: Sets the frequency coupling offset. If frequency coupling is on, the Tx frequency will automatically trail the Rx frequency by this amount. Please note that the instrument will prevent any coupling offset setting that will make the Tx frequency go beyond the min/max values. The query returns the current coupling offset in Hz.

Cmd Parameters: `<Value>`

Query Parameters: **NA**

Range: -1000000000 Hz to 1000000000 Hz

Default Value: 0 Hz

Default Unit: Hz

Example: To set coupling offset to 200 MHz:

`:SENSe:FREQuency:COUPling:OFFSet 200000000`

Front Panel Access: **Frequency**, Coupling Offset

[:SENSe]:FREQuency:SPAN 25|50|100|500|1000|5000
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in P25 Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `25|50|100|500|1000|5000`

Query Parameters: NA

Range: `25|50|100|500|1000|5000`

Default Value: 25

Default Unit: kHz

Example: To set the span to 1 MHz:

`:SENSe:FREQuency:SPAN 1000`

Front Panel Access: **Frequency**, Span

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In P25 Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To adjust range:

`:POWer:RANGe`

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In P25 Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To turn auto ranging off:

```
:POWer:RANGe:AUTO OFF
```

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe]:SYMBolspan <value>
[:SENSe]:SYMBolspan?

Description: Sets the symbol span. Please note that this setting only affects the Eye Diagram in the P25 Analyzer measurement. Please note that setting the symbol span will restart the sweep.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 2 to 5

Default Value: 2

Default Unit: **NA**

Example: To set the symbol span to 4:

```
:SYMBolspan 4
```

Front Panel Access: **Measurement**, P25 Analyzer, Symbol Span

Chapter 11 — P25 Phase 2 Commands

11-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

`:ABORt`

Description: Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To abort a measurement:

`:ABORt`

Front Panel Access: **NA**

11-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

:CONFigure?

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `CONFigure` command or a `MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
`SIGA`	P25p2 Analyzer
`COV`	P25p2 Coverage
`CONT`	P25p2 Control
`BITC`	P25p2 Bit Capture

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:BITCap

Description: This command configures the P25p2 Bit Capture measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other. Please note that you must have the Rx pattern set to `VOICe` to set the P25p2 Bit Capture measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25p2 Bit Capture:

`:CONFigure:BITCap`

Related Command: `:DM:PATTern VOICe`

Front Panel Access: **Measurement**, P25p2 Bit Capture

:CONFigure:CONTrol

Description: This command configures the P25p2 Control measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other. Please note that you must have the Rx pattern set to `VOICe` or `CTRLchan` to set the P25p2 Control measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25p2 Control:

`:CONFigure:CONTrol`

Related Command: `:DM:PATTern VOICe`
`:DM:PATTern CTRLchan`

Front Panel Access: **Measurement**, P25p2 Control

:CONFigure:COVerage

Description: This command configures the P25p2 Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25p2 Coverage:

```
:CONFigure:COVerage
```

Front Panel Access: **Measurement**, P25p2 Coverage

:CONFigure:SIGAnalyzer

Description: This command configures the P25p2 Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to P25p2 Analyzer:

```
:CONFigure:SIGAnalyzer
```

Front Panel Access:**Measurement**, P25p2 Analyzer

11-3 :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[:WINDow]:TRACe:SELect?

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

`:DISPlay:TRACe:SELect?`

Front Panel Access: **Measurement**, P25p2 Analyzer, Active Graph

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. In the P25p2 Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

`:DISPlay:TRACe:Y:PDIVision 8`

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the P25p2 Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Unit: dBm

Example: To set the reference level to -40:

`:DISPlay:TRACe:Y:RLEVel -40`

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, BER, and Mod Fid data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|BER|MODFid`

The query version of this command returns `"RSSI"` if the mapping type is set to RSSI, `"BER"` if set to BER, and `"MODF"` if set to Mod Fid.

Please note that this command only works when the current measurement is set to P25p2 Coverage. Refer to the Related Command below.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|BER|MODFid

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to Mod Fid:

`:DISPlay:TRACe:FORMat:COVerage MODFid`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, P25p2 Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`LINConstellation|SPECtrum|HISTogram|SUMMary|EYEDiagram|PROFile|ACTIve|ADJAcent|BANDplan|SECOndctrl`

The query version of this command returns one of the following:
"LINC" if the specified trace graph type is set to linear constellation
"SPEC" if set to Spectrum
"HIST" if set to Histogram
"SUMM" if set to Demodulation Summary
"EYED" if set to Eye Diagram
"PROF" if set to Power Profile
"ACTI" if set to Active Channel Summary
"ADJA" if set to Adjacent Channel Summary
"BAND" if set to Band Plan Summary
"SECO" if set to Backup Control Channel Summary

Please note that this command only works when the current measurement is set to P25p2 Analyzer.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: LINConstellation|SPECtrum|HISTogram|SUMMary|EYEDiagram|PROFile|ACTIve|ADJAcent|BANDplan|SECOndctrl

Default Value: Trace 1: Linear Constellation
Trace 2: Spectrum
Trace 3: Histogram
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Eye Diagram:

`:DISPlay:TRACe2:FORMat:SIGAnalyzer EYEDiagram`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, P25p2 Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4 for P25p2 Analyzer. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

`:DISPlay:TRACe2:SELect`

Front Panel Access: **Measurement**, P25p2 Analyzer, Active Graph

11-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent P25p2 Coverage numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch P25p2 Coverage numerical data:

`:FETCh:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:FETCh:SIGAnalyzer?

Description: Returns the most recent P25p2 Analyzer numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch P25p2 Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

11-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to "Interpreting Returned Data" on page 11-12 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

`:FORMat INTeger,32`

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL | CONStellation | HISTogram | SPECtrum | EYEDiagram | PROFile" command on page 11-35.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. For example, *<CONSTELLATION>* is *15* bytes. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum and Histogram datapoints consists of 4 bytes.
- Eye Diagram datapoints [12 X-axis points and (12 x ((551 / Number Of Symbols) - 1)) Y-axis points] are 4 bytes each.
- Each Constellation datapoint consists of 8 bytes.
  - The first 4 bytes are the I component
  - The next 4 bytes are the Q component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

  Converting INTeger,32 Example:

  The instrument returns the following Spectrum data point in INT,32 format:

  b9 c0 fd ff

  1. Convert from little endian to big endian:

     ff fd c0 b9

  2. Since the MSb in both components is 1, they are negative numbers.
  3. The binary representation is:

     11111111111111011100000010111001

  4. Convert from two's complement (not the bits and add 1):

     100011111101000111

  5. Convert the binary values to decimal:

     147271

  6. Take out the 1e3 scale factor:

     147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:

   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

11-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

11-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to P25p2 Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure P25p2 Coverage numerical data:

`:MEASure:COVerage?`

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to P25p2 Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: The `squelch` setting `:DM:SQUelch` will blank out (--) all summary measurements on the instrument display except for Received Pwr when the received power level is lower than the squelch power setting. The received power level is also affected by the Rx Power Offset setting. The query command will still return values even if the instrument display is blanked out.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure P25p2 Analyzer numerical data:

`:MEASure:SIGAnalyzer?`

Front Panel Access: **NA**

11-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a setup file:

`:MMEMory:LOAD:STATe 1,"xxx.stp"`

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use `:INSTrument:SELect` or `:INSTrument:NSELect` to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by `<filename>` should be available at the current save location. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

"`.spa`" for SPA measurement
"`.mna`" for VNA and VVM measurements
"`.hipm`" for HiPM measurements
"`.pm`" for PM measurements
"`.cwsg`" for CWSG measurements
"`.afp`" for AM/FM/PM measurements
"`.ia`" for Interference Analysis measurements
"`.cs`" for Channel Scanner measurements
"`.wmxd`" for WiMAX
"`.wmxe`" for Mobile WiMAX

"`.lte`" for LTE measurements
"`.p25`" for P25 measurements
"`.p252`" for P25p2 measurements
"`.nxdn`" for NXDN measurements
"`.dpmr`" for dPMR measurements
"`.dmr2`" for DMR 2 measurements
"`.ptc`" for PTC measurements
"`.tetra`" for TETRA measurements
"`.nbfm`" for NBFM measurements

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

`:MMEMory:LOAD:TRACe 1,"xxx.p252"`

Front Panel Access: **Shift 7** (File), Recall Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be recalled on the instrument.

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a setup file:

`:MMEMory:STORe:STATe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a measurement file:

`:MMEMory:STORe:TRACe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be saved on the instrument.

11-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new P25p2 Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT`; `:INITiate`; `:FETCh:COVerage?` P25p2 Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read P25p2 Coverage numerical data:

`:READ:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new P25p2 Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT; :INITiate; :FETCh:SIGAnalyzer?`

P25p2 Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?` Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read P25p2 Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

11-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the P25p2 signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

`:SOURce:CORRection:OFFSet -10`

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

`:SOURce:DM:PATTern 2`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format:

Patterns when Mod Type is set to Base Station (`:DM:FORMat BS`) and TX Slot set to None:

0: p252_bs_1031
1: p252_bs_1031_cal
2: p252_bs_silence
3: cw
4: am_1khz_audio
5: fm_1khz_audio

Patterns when Mod Type is set to Mobile Station (`:DM:FORMat MS`) and TX Slot set to None:

0: p252_ms_1031_0
1: p252_ms_1031_1
2: p252_ms_1031_2
3: p252_ms_1031_cal_0
4: p252_ms_1031_cal_1
5: p252_ms_silence_0
6: p252_ms_silence_1
7: cw
8: am_1khz_audio
9: fm_1khz_audio

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

```
:SOURce:DM:PATTern:LIST?
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

```
:SOURce:FREQuency:CENTer 145000000
```

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the P25p2 signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or
70710678 fV to 223606797749978 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

```
:SOURce:POWer -10
```

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

`:SOURce:STATe ON`

Front Panel Access: **Turn Sig-Gen ON/OFF**

11-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the `MMEMory` subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as `"NAME=VALUE[UNITS]"`. Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 11-1.

Cmd Parameters: NA

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To get the trace preamble:

`:TRACe:PREamble?`

Front Panel Access: NA

Table 11-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.

Table 11-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style)..
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.

Table 11-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.

Table 11-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).

Table 11-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 11-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).

Table 11-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Used by DSP for decoding the pattern.
SYSTEM_ID	Used by DSP for decoding the pattern.
COLOR_CODE	Used by DSP for decoding the pattern.

:TRACe[:DATA]? ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram|PROFile

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by :FORMat:DATA. Trace setup information can be acquired using :TRACe[:DATA]:PREamble? Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
<CONSTELLATION>	</CONSTELLATION>
<HISTOGRAM>	</HISTOGRAM>
<SPECTRUM>	</SPECTRUM>
<EYE_DIAGRAM>	</EYE_DIAGRAM>
<POWER_PROFILE>	</POWER_PROFILE>

The tags listed above will always show up in the response and will always be in the order described.

Constellation data will have two elements per point. There will be 551 constellation points total.

Spectrum, histogram, and power profile data will only have one element per point. There will also only be 551 points per trace.

Eye diagram will have 12 X-axis points followed by (12 x ((551 / Number Of Symbols) - 1)) Y-axis points.

Each eye line will consist of 12 Y-axis points combined with the X-axis points that are sent at the beginning.

Please note that this command only works in the P25p2 Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: `ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram|PROFile`

Range: ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram|PROFile

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

`:TRACe? SPECtrum`

Front Panel Access: **NA**

11-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description: Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the P25p2 Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm. If the unit is set to Watts, the P25p2 Signal Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the P25p2 Signal Analyzer received power and squelch setting will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the receiver units to watts:

`:UNIT:POWer:RX WATT`

Front Panel Access: **Amplitude**, Units, Rx Units

:UNIT:POWer:TX DBM|WATT|VOLTs
:UNIT:POWer:TX?

Description: Sets the generator unit to dBm or Watts or Volts. If the unit is set to dBm, the Tx Output Lvl setting will be set and queried in dBm. If the unit is set to Watts, the Tx Output Lvl setting will be set and queried in fW. If the unit is set to Volts, the Tx Output Lvl will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the generator units to volts:

`:UNIT:POWer:TX VOLT`

Front Panel Access: **Amplitude**, Units, Tx Units

11-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:APPLication:TST?

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

```
:APPLication:TST?
```

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. [:SENSe]:APPLication:TST? must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 show the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 14 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

```
:APPLication:TST?;:APPLication:TST:RESult?
```

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:AVERage:COUNt <integer>
[:SENSe]:AVERage:COUNt?

Description: Sets the number of times the numerical values in the P25p2 Analyzer Summary window are averaged.

Cmd Parameters: <integer>

Query Parameters: **NA**

Range: 1 to 25

Default Value: 1

Default Unit: **NA**

Example: To set averaging to 15:

`:AVERage:COUNt 15`

Front Panel Access: **Setup**, Averaging

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description: Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm.

If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted.

The Received Pwr value in the Summary Table is also affected by changing this value.

The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the external attenuation to 30 dB:

`:CORRection:OFFSet 30`

Front Panel Access: **Amplitude**, Rx Power Offset

[:SENSe]:DM:FORMat BS|MS
[:SENSe]:DM:FORMat?

Description: Sets the modulation type to Base Station (BS) or Mobile Station (MS). Please note that setting the modulation type will restart the sweep.

Cmd Parameters: `BS|MS`

Query Parameters: **NA**

Range: BS|MS

Default Value: BS

Default Unit: **NA**

Example: To set the modulation type to MS:

`:DM:FORMat MS`

Front Panel Access: **Setup**, Mod Type

[:SENSe]:DM:PATTern 1031hz|SILence|VOICe|CTRLchan
[:SENSe]:DM:PATTern?

Description: Sets the receiver pattern type. Please note that setting the Rx Pattern will restart the sweep.

Cmd Parameters: `1031hz|SILence|VOICe|CTRLchan`

Query Parameters: **NA**

Range: 1031hz|SILence|VOICe|CTRLchan

Default Value: 1031hz

Default Unit: **NA**

Example: To set the modulation type to voice:

`:DM:PATTern VOICe`

Front Panel Access: **Setup**, Rx Pattern

[:SENSe]:DM:SQUelch <value>
[:SENSe]:DM:SQUelch?

Description: Sets the squelch power level. The squelch is only applied to the P25p2 Analyzer Summary window on the front panel and will blank out (--) all summary measurements except for Received Pwr when the received power level is lower than the squelch power setting. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: NA

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW
or 223.6 mV to 223.61 nV

Default Value: -100 dBm or 100 fW or 2.24 µV

Default Unit: dBm or fW or fV

Example: To set the squelch to -10 dBm:

`:DM:SQUelch -10`

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

`:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:COUPling OFF|ON|0|1
[:SENSe]:FREQuency:COUPling?

Description: Turns on frequency coupling. When frequency coupling is on, the Tx frequency cannot be set directly. The Rx Frequency and coupling offset must be used to set the desired Tx frequency. The Tx frequency will automatically trail the Rx frequency by the frequency coupling offset every time the Rx frequency is set. Please note that turning on frequency coupling will automatically move the Tx frequency to the Rx frequency plus any frequency coupling offset. If the Rx frequency and frequency coupling offset is at a setting where the Tx frequency will be beyond the min/max limits, the instrument will not allow coupling to be turned on. The query command returns the state of the frequency coupling setting. A return value of 1 is ON, and a return value of 0 is OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn Rx/Tx frequency coupling on:

```
:SENSe:FREQuency:COUPling ON
```

Front Panel Access: **Frequency**, Rx/Tx Coupling

[:SENSe]:FREQuency:COUPling:OFFSet <value>
[:SENSe]:FREQuency:COUPling:OFFSet?

Description: Sets the frequency coupling offset. If frequency coupling is on, the Tx frequency will automatically trail the Rx frequency by this amount. Please note that the instrument will prevent any coupling offset setting that will make the Tx frequency go beyond the min/max values. The query returns the current coupling offset in Hz.

Cmd Parameters: `<Value>`

Query Parameters: **NA**

Range: -1000000000 Hz to 1000000000 Hz

Default Value: 0 Hz

Default Unit: Hz

Example: To set coupling offset to 200 MHz:

```
:SENSe:FREQuency:COUPling:OFFSet 200000000
```

Front Panel Access: **Frequency**, Coupling Offset

[:SENSe]:FREQuency:SPAN 25|50|100|500|1000|5000
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in P25p2 Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `25|50|100|500|1000|5000`

Query Parameters: NA

Range: `25|50|100|500|1000|5000`

Default Value: 25

Default Unit: kHz

Example: To set the span to 1 MHz:

```
:SENSe:FREQuency:SPAN 1000
```

Front Panel Access: **Frequency**, Span

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In P25p2 Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To adjust range:

```
:POWer:RANGe
```

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In P25p2 Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To turn auto ranging off:

`:POWer:RANGe:AUTO OFF`

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe]:SYMBolspan <value>
[:SENSe]:SYMBolspan?

Description: Sets the symbol span. Please note that this setting only affects the Eye Diagram in the P25p2 Analyzer measurement. Please note that setting the symbol span will restart the sweep.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 2 to 5

Default Value: 2

Default Unit: **NA**

Example: To set the symbol span to 4:

`:SYMBolspan 4`

Front Panel Access: **Measurement**, P25p2 Analyzer, Symbol Span

Chapter 12 — NXDN Commands

12-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Description: Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To abort a measurement:

`:ABORt`

Front Panel Access: **NA**

12-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

`:CONFigure?`

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `CONFigure` command or a `MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
`SIGA`	NXDN Analyzer
`COV`	NXDN Coverage
`CONT`	NXDN Control
`BITC`	NXDN Bit Capture

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:BITCap

Description: This command configures the NXDN Bit Capture measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other. Please note that you must have the Rx pattern set to `VOICe` to set the NXDN Bit Capture measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NXDN Bit Capture:

`:CONFigure:BITCap`

Related Command: `:DM:PATTern VOICe`

Front Panel Access: **Measurement**, NXDN Bit Capture

:CONFigure:CONTrol

Description: This command configures the NXDN Control measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other. Please note that you must have the Rx pattern set to `VOICe` or `CTRLchan` to set the NXDN Control measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NXDN Control:

`:CONFigure:CONTrol`

Related Command: `:DM:PATTern VOICe`
`:DM:PATTern CTRLchan`

Front Panel Access: **Measurement**, NXDN Control

:CONFigure:COVerage

Description: This command configures the NXDN Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NXDN Coverage:

`:CONFigure:COVerage`

Front Panel Access: **Measurement**, NXDN Coverage

:CONFigure:SIGAnalyzer

Description: This command configures the NXDN Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NXDN Analyzer:

`:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, NXDN Analyzer

12-3 :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[:WINDow]:TRACe:SELect?

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

`:DISPlay:TRACe:SELect?`

Front Panel Access: **Measurement**, NXDN Analyzer, Active Graph

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. In the NXDN Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

`:DISPlay:TRACe:Y:PDIVision 8`

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the NXDN Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Unit: dBm

Example: To set the reference level to -40:

`:DISPlay:TRACe:Y:RLEVel -40`

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, BER, and Mod Fid data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|BER|MODFid`

The query version of this command returns `"RSSI"` if the mapping type is set to RSSI, `"BER"` if set to BER, and `"MODF"` if set to Mod Fid.

Please note that this command only works when the current measurement is set to NXDN Coverage. Refer to the Related Command below.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|BER|MODFid

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to Mod Fid:

`:DISPlay:TRACe:FORMat:COVerage MODFid`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, NXDN Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`CONStellation|SPECtrum|HISTogram|SUMMary|EYEDiagram|LINConstellation`

The query version of this command returns "CONS" if the specified trace graph type is set to Constellation, "HIST" if set to Histogram, "SPEC" if set to Spectrum, "SUMM" if set to Summary, "EYED" if set to Eye Diagram, and "LINC" if set to linear constellation.

Please note that this command only works when the current measurement is set to NXDN Analyzer.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: CONStellation | SPECtrum | HISTogram | SUMMary | EYEDiagram | LINConstellation

Default Value: Trace 1: Linear Constellation
Trace 2: Spectrum
Trace 3: Histogram
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Eye Diagram:

`:DISPlay:TRACe2:FORMat:SIGAnalyzer EYEDiagram`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, NXDN Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4 for NXDN Analyzer. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

`:DISPlay:TRACe2:SELect`

Front Panel Access: **Measurement**, NXDN Analyzer, Active Graph

12-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent NXDN Coverage numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch NXDN Coverage numerical data:

`:FETCh:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:FETCh:SIGAnalyzer?

Description: Returns the most recent NXDN Analyzer numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
RAN (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch NXDN Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

12-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format.
The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to “Interpreting Returned Data” on page 12-11 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

```
:FORMat INTeger,32
```

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL | CONStellation | HISTogram | SPECtrum | EYEDiagram" command on page 12-31.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. For example, *<CONSTELLATION>* is *15* bytes. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum and Histogram datapoints consists of 4 bytes.
- Eye Diagram datapoints [12 X-axis points and (12 x ((551 / Number Of Symbols) - 1)) Y-axis points] are 4 bytes each.
- Each Constellation datapoint consists of 8 bytes.
  - The first 4 bytes are the I component
  - The next 4 bytes are the Q component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

  Converting INTeger,32 Example:

  The instrument returns the following Spectrum data point in INT,32 format:

  b9 c0 fd ff

  1. Convert from little endian to big endian:

     ff fd c0 b9

  2. Since the MSb in both components is 1, they are negative numbers.
  3. The binary representation is:

     11111111111111011100000010111001

  4. Convert from two's complement (not the bits and add 1):

     100011111101000111

  5. Convert the binary values to decimal:

     147271

  6. Take out the 1e3 scale factor:

     147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:

   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

12-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

12-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to NXDN Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure NXDN Coverage numerical data:

`:MEASure:COVerage?`

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to NXDN Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
RAN (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: The `squelch` setting `[:SENSe]:DM:SQUelch` will blank out (--) all summary measurements on the instrument display except for Received Pwr when the received power level is lower than the squelch power setting. The received power level is also affected by the Rx Power Offset setting. The query command will still return values even if the instrument display is blanked out.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure NXDN Analyzer numerical data:

```
:MEASure:SIGAnalyzer?
```

Front Panel Access: **NA**

12-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a setup file:

```
:MMEMory:LOAD:STATe 1,"xxx.stp"
```

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use `:INSTrument:SELect` or `:INSTrument:NSELect` to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by `<filename>` should be available at the current save location. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

"`.spa`" for SPA measurement
"`.mna`" for VNA and VVM measurements
"`.hipm`" for HiPM measurements
"`.pm`" for PM measurements
"`.cwsg`" for CWSG measurements
"`.afp`" for AM/FM/PM measurements
"`.ia`" for Interference Analysis measurements
"`.cs`" for Channel Scanner measurements
"`.wmxd`" for WiMAX
"`.wmxe`" for Mobile WiMAX
"`.lte`" for LTE measurements
"`.p25`" for P25 measurements
"`.p252`" for P25p2 measurements
"`.nxdn`" for NXDN measurements
"`.dpmr`" for dPMR measurements
"`.dmr2`" for DMR 2 measurements
"`.ptc`" for PTC measurements
"`.tetra`" for TETRA measurements
"`.nbfm`" for NBFM measurements

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

```
:MMEMory:LOAD:TRACe 1,"xxx.nxdn"
```

Front Panel Access: **Shift 7** (File), Recall Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be recalled on the instrument.

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: `<integer>`,`<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a setup file:

`:MMEMory:STORe:STATe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: `<integer>`,`<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a measurement file:

`:MMEMory:STORe:TRACe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be saved on the instrument.

12-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new NXDN Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT`; `:INITiate`; `:FETCh:COVerage?` NXDN Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read NXDN Coverage numerical data:

`:READ:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new NXDN Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT; :INITiate; :FETCh:SIGAnalyzer?`

NXDN Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?` Data is returned as 7 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
RAN (hex)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read NXDN Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

12-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the NXDN signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

```
:SOURce:CORRection:OFFSet -10
```

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

```
:SOURce:DM:PATTern 2
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format:

0: nxdn_1031_XXXX
1: nxdn_511(O.153)_XXXX
2: nxdn_high_dev_XXXX
3: nxdn_low_dev_XXXX
4: nxdn_udch_pat_10_XXXX
5: nxdn_cac_XXXX
6: cw
7: am_1khz_audio
8: fm_1khz_audio

XXXX = 4800 (6.25 kHz) or 9600 (12.5 kHz) depending on mod bandwidth.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

```
:SOURce:DM:PATTern:LIST?
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

```
:SOURce:FREQuency:CENTer 145000000
```

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the NXDN signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or 70710678 fV to 223606797749978 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

`:SOURce:POWer -10`

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

`:SOURce:STATe ON`

Front Panel Access: **Turn Sig-Gen ON/OFF**

12-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the `MMEMory` subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "`NAME=VALUE[UNITS]`". Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 12-1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To get the trace preamble:

`:TRACe:PREamble?`

Front Panel Access: **NA**

Table 12-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.

Table 12-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style).
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.

Table 12-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.

Table 12-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).

Table 12-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 12-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).

Table 12-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Not used.
SYSTEM_ID	Not used.
COLOR_CODE	Not used.

:TRACe[:DATA]? ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by `:FORMat:DATA`. Trace setup information can be acquired using `:TRACe[:DATA]:PREamble?` Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
`<CONSTELLATION>`	`</CONSTELLATION>`
`<HISTOGRAM>`	`</HISTOGRAM>`
`<SPECTRUM>`	`</SPECTRUM>`
`<EYE_DIAGRAM>`	`</EYE_DIAGRAM>`

The tags listed above will always show up in the response and will always be in the order described.

Constellation data will have two elements per point. There will be 551 constellation points total.

Spectrum and histogram data will only have one element per point. There will also only be 551 points per trace.

Eye diagram will have 12 X-axis points followed by (12 x ((551 / Number Of Symbols) - 1)) Y-axis points.

Each eye line will consist of 12 Y-axis points combined with the X-axis points that are sent at the beginning.

Please note that this command only works in the NXDN Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: `ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram`

Range: ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

```
:TRACe? SPECtrum
```

Front Panel Access: **NA**

12-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description: Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the NXDN Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm. If the unit is set to Watts, the NXDN Signal Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the NXDN Signal Analyzer received power and squelch setting will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the receiver units to watts:

```
:UNIT:POWer:RX WATT
```

Front Panel Access: **Amplitude**, Units, Rx Units

:UNIT:POWer:TX DBM|WATT|VOLTs
:UNIT:POWer:TX?

Description: Sets the generator unit to dBm or Watts or Volts. If the unit is set to dBm, the Tx Output Lvl setting will be set and queried in dBm. If the unit is set to Watts, the Tx Output Lvl setting will be set and queried in fW. If the unit is set to Volts, the Tx Output Lvl will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the generator units to volts:

```
:UNIT:POWer:TX VOLT
```

Front Panel Access: **Amplitude**, Units, Tx Units

12-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:APPLication:TST?

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

`:SENSe:APPLication:TST?`

Front Panel Access: **Shift 8** (System), Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. [:SENSe]:APPLication:TST? must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 shown the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 14 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

```
:APPLication:TST?;:APPLication:TST:RESult?
```

Front Panel Access: **Shift 8** (System), Application Self Test

[:SENSe]:AVERage:COUNt <integer>
[:SENSe]:AVERage:COUNt?

Description: Sets the number of times the numerical values in the NXDN Analyzer Summary window are averaged. Please note that RAN is not averaged.

Cmd Parameters: <integer>

Query Parameters: **NA**

Range: 1 to 25

Default Value: 1

Default Unit: **NA**

Example: To set averaging to 15:

```
:AVERage:COUNt 15
```

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description: Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm.

If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted.

The Received Pwr value in the Summary Table is also affected by changing this value.

The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the external attenuation to 30 dB:

```
:CORRection:OFFSet 30
```

Front Panel Access: **Amplitude**, Rx Power Offset

[:SENSe]:DM:BWIDth 12.5|6.25
[:SENSe]:DM:BWIDth?

Description: Sets the modulation bandwidth. Please note that setting the modulation bandwidth will restart the sweep.

Note: Modulation bandwidth value is set and returned in kHz.

Cmd Parameters: `12.5|6.25`

Query Parameters: **NA**

Range: 12.5|6.25

Default Value: 12.5

Default Unit: kHz

Example: To set the modulation bandwidth to 6.25 kHz:

`:DM:BWIDth 6.25`

Front Panel Access: **Setup**, Mod Bandwidth

[:SENSe]:DM:PATTern 1031hz|O.153|VOICe|CTRLchan
[:SENSe]:DM:PATTern?

Description: Sets the receiver pattern type. Please note that setting the Rx pattern type will restart the sweep.

Cmd Parameters: `1031hz|O.153|VOICe|CTRLchan`

Query Parameters: **NA**

Range: 1031hz|O.153|VOICe|CTRLchan

Default Value: 1031hz

Default Unit: **NA**

Example: To set the modulation pattern to voice:

`:DM:PATTern VOICe`

Front Panel Access: **Setup**, Rx Pattern

[:SENSe]:DM:SQUelch <value>
[:SENSe]:DM:SQUelch?

Description: Sets the squelch power level. The squelch is only applied to the NXDN Analyzer Summary window on the front panel and will blank out (--) all summary measurements except for Received Pwr when the received power level is lower than the squelch power setting. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW
or 223.6 mV to 223.61 nV

Default Value: -100 dBm or 100 fW or 2.24 µV

Default Unit: dBm or fW or fV

Example: To set the squelch to -10 dBm:

```
:DM:SQUelch -10
```

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

`:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:COUPling OFF|ON|0|1
[:SENSe]:FREQuency:COUPling?

Description: Turns on frequency coupling. When frequency coupling is on, the Tx frequency cannot be set directly. The Rx Frequency and coupling offset must be used to set the desired Tx frequency. The Tx frequency will automatically trail the Rx frequency by the frequency coupling offset every time the Rx frequency is set. Please note that turning on frequency coupling will automatically move the Tx frequency to the Rx frequency plus any frequency coupling offset. If the Rx frequency and frequency coupling offset is at a setting where the Tx frequency will be beyond the min/max limits, the instrument will not allow coupling to be turned on. The query command returns the state of the frequency coupling setting. A return value of 1 is ON, and a return value of 0 is OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn Rx/Tx frequency coupling on:

`:SENSe:FREQuency:COUPling ON`

Front Panel Access: **Frequency**, Rx/Tx Coupling

[:SENSe]:FREQuency:COUPling:OFFSet <value>
[:SENSe]:FREQuency:COUPling:OFFSet?

Description: Sets the frequency coupling offset. If frequency coupling is on, the Tx frequency will automatically trail the Rx frequency by this amount. Please note that the instrument will prevent any coupling offset setting that will make the Tx frequency go beyond the min/max values.
The query returns the current coupling offset in Hz.

Cmd Parameters: `<Value>`

Query Parameters: **NA**

Range: -1000000000 Hz to 1000000000 Hz

Default Value: 0 Hz

Default Unit: Hz

Example: To set coupling offset to 200 MHz:

`:SENSe:FREQuency:COUPling:OFFSet 200000000`

Front Panel Access: **Frequency**, Coupling Offset

[:SENSe]:FREQuency:SPAN 25|50|100|500|1000|5000
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in NXDN Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `25|50|100|500|1000|5000`

Query Parameters: NA

Range: 25|50|100|500|1000|5000

Default Value: 25

Default Unit: kHz

Example: To set the span to 1 MHz:

`:SENSe:FREQuency:SPAN 1000`

Front Panel Access: **Frequency**, Span

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In NXDN Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: NA

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To adjust range:

`:POWer:RANGe`

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In NXDN Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: NA

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: NA

Example: To turn auto ranging off:

`:POWer:RANGe:AUTO OFF`

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe]:SYMBolspan <value>
[:SENSe]:SYMBolspan?

Description: Sets the symbol span. Please note that this setting only affects the Eye Diagram in the NXDN Analyzer measurement. Please note that setting the symbol span will restart the sweep.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 2 to 5

Default Value: 2

Default Unit: **NA**

Example: To set the symbol span to 4:

```
:SYMBolspan 4
```

Front Panel Access: **Measurement**, NXDN Analyzer, Symbol Span

Chapter 13 — dPMR Commands

13-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

`:ABORtfile`

Description:	Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.
Cmd Parameters:	**NA**
Query Parameters:	**NA**
Range:	**NA**
Default Value:	**NA**
Default Unit:	**NA**
Example:	To abort a measurement: `:ABORt`
Front Panel Access:	**NA**

13-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

`:CONFigure?`

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `CONFigure` command or a `MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
`SIGA`	dPMR Analyzer
`COV`	dPMR Coverage

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:COVerage

Description: This command configures the dPMR Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to dPMR Coverage:

`:CONFigure:COVerage`

Front Panel Access: **Measurement**, dPMR Coverage

:CONFigure:SIGAnalyzer

Description: This command configures the dPMR Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to dPMR Analyzer:

`:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, dPMR Analyzer

13-3 :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[:WINDow]:TRACe:SELect?`

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

`:DISPlay:TRACe:SELect?`

Front Panel Access: **Measurement**, dPMR Analyzer, Active Graph

`:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>`
`:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?`

Description: Sets the scale per division for the y-axis. In the dPMR Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

`:DISPlay:TRACe:Y:PDIVision 8`

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the dPMR Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Unit: dBm

Example: To set the reference level to -40:

`:DISPlay:TRACe:Y:RLEVel -40`

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, BER, and Mod Fid data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|BER|MODFid`

The query version of this command returns "RSSI" if the mapping type is set to RSSI, "BER" if set to BER, and "MODF" if set to Mod Fid.

Please note that this command only works when the current measurement is set to dPMR Coverage. Refer to the Related Command below.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|BER|MODFid

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to Mod Fid:

`:DISPlay:TRACe:FORMat:COVerage MODFid`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, dPMR Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`CONStellation|SPECtrum|HISTogram|SUMMary|EYEDiagram|LINConstellation`

The query version of this command returns "CONS" if the specified trace graph type is set to Constellation, "HIST" if set to Histogram, "SPEC" if set to Spectrum, "SUMM" if set to Summary, "EYED" if set to Eye Diagram, and "LINC" if set to linear constellation.

Please note that this command only works when the current measurement is set to dPMR Analyzer.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: CONStellation | SPECtrum | HISTogram | SUMMary | EYEDiagram | LINConstellation

Default Value: Trace 1: Linear Constellation
Trace 2: Spectrum
Trace 3: Histogram
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Eye Diagram:

`:DISPlay:TRACe2:FORMat:SIGAnalyzer EYEDiagram`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, dPMR Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4 for dPMR Analyzer. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

`:DISPlay:TRACe2:SELect`

Front Panel Access: **Measurement**, dPMR Analyzer, Active Graph

13-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent dPMR Coverage numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch dPMR Coverage numerical data:

`:FETCh:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:FETCh:SIGAnalyzer?

Description: Returns the most recent dPMR Analyzer numerical measurement results. Data is returned as 5 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
Symbol Dev (Hz as float)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch dPMR Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

13-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

`:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32`
`:FORMat[:READings][:DATA]?`

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to "Interpreting Returned Data" on page 13-10 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

`:FORMat INTeger,32`

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL | CONStellation | HISTogram | SPECtrum | EYEDiagram" command on page 13-30.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. For example, *<CONSTELLATION>* is *15* bytes. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum and Histogram datapoints consists of 4 bytes.
- Eye Diagram datapoints [12 X-axis points and (12 x ((551 / Number Of Symbols) - 1)) Y-axis points] are 4 bytes each.
- Each Constellation datapoint consists of 8 bytes.
  - The first 4 bytes are the I component
  - The next 4 bytes are the Q component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

Converting INTeger,32 Example:

The instrument returns the following Spectrum data point in INT,32 format:

b9 c0 fd ff

1. Convert from little endian to big endian:

   ff fd c0 b9

2. Since the MSb in both components is 1, they are negative numbers.
3. The binary representation is:

   11111111111111011100000010111001

4. Convert from two's complement (not the bits and add 1):

   100011111101000111

5. Convert the binary values to decimal:

   147271

6. Take out the 1e3 scale factor:

   147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:
   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

13-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: NA

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: NA

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: NA

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

13-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to dPMR Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure dPMR Coverage numerical data:

`:MEASure:COVerage?`

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to dPMR Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

Data is returned as 5 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
Symbol Dev (Hz as float)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: The `squelch` setting `[:SENSe]:DM:SQUelch` will blank out (--) all summary measurements on the instrument display except for Received Pwr when the received power level is lower than the squelch power setting. The received power level is also affected by the Rx Power Offset setting. The query command will still return values even if the instrument display is blanked out.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure dPMR Analyzer numerical data:

`:MEASure:SIGAnalyzer?`

Front Panel Access: **NA**

13-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a setup file:

`:MMEMory:LOAD:STATe 1,"xxx.stp"`

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use `:INSTrument:SELect` or `:INSTrument:NSELect` to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by `<filename>` should be available at the current save location. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

"`.spa`" for SPA measurement
"`.mna`" for VNA and VVM measurements
"`.hipm`" for HiPM measurements
"`.pm`" for PM measurements
"`.cwsg`" for CWSG measurements
"`.afp`" for AM/FM/PM measurements
"`.ia`" for Interference Analysis measurements
"`.cs`" for Channel Scanner measurements
"`.wmxd`" for WiMAX
"`.wmxe`" for Mobile WiMAX
"`.lte`" for LTE measurements
"`.p25`" for P25 measurements
"`.p252`" for P25p2 measurements
"`.nxdn`" for NXDN measurements
"`.dpmr`" for dPMR measurements
"`.dmr2`" for DMR 2 measurements
"`.ptc`" for PTC measurements
"`.tetra`" for TETRA measurements
"`.nbfm`" for NBFM measurements

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

`:MMEMory:LOAD:TRACe 1,"xxx.dpmr"`

Front Panel Access: **Shift 7** (File), Recall Measurement

Note	IQ Data measurements can not be recalled on the instrument.

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by <filename>. <filename> should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: <integer>,<filename>

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To save a setup file:

:MMEMory:STORe:STATe 0,"xxx"

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by <filename>. <filename> should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: <integer>,<filename>

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To save a measurement file:

:MMEMory:STORe:TRACe 0,"xxx"

Front Panel Access: **Shift 7** (File), Save Measurement

Note	IQ Data measurements can not be saved on the instrument.

13-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new dPMR Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT`; `:INITiate`; `:FETCh:COVerage?` dPMR Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read dPMR Coverage numerical data:

`:READ:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new dPMR Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT; :INITiate; :FETCh:SIGAnalyzer?`

dPMR Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?` Data is returned as 5 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
Symbol Dev (Hz as float)
Symbol Rate Error (Hz as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read dPMR Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

13-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the dPMR signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

`:SOURce:CORRection:OFFSet -10`

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

`:SOURce:DM:PATTern 2`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format:

0: cw
1: am_1khz_audio
2: fm_1khz_audio

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

`:SOURce:DM:PATTern:LIST?`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

`:SOURce:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the dPMR signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or
70710678 fV to 223606797749978 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

```
:SOURce:POWer -10
```

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

```
:SOURce:STATe ON
```

Front Panel Access: **Turn Sig-Gen ON/OFF**

13-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the `MMEMory` subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "`NAME=VALUE[UNITS]`". Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 13-1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To get the trace preamble:

`:TRACe:PREamble?`

Front Panel Access: **NA**

Table 13-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.

Table 13-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style).
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.

Table 13-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.

Table 13-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).

Table 13-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 13-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).

Table 13-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Not used.
SYSTEM_ID	Not used.
COLOR_CODE	Not used.

:TRACe[:DATA]? ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by `:FORMat:DATA`. Trace setup information can be acquired using `:TRACe[:DATA]:PREamble?` Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
`<CONSTELLATION>`	`</CONSTELLATION>`
`<HISTOGRAM>`	`</HISTOGRAM>`
`<SPECTRUM>`	`</SPECTRUM>`
`<EYE_DIAGRAM>`	`</EYE_DIAGRAM>`

The tags listed above will always show up in the response and will always be in the order described.

Constellation data will have two elements per point. There will be 551 constellation points total.

Spectrum and histogram data will only have one element per point. There will also only be 551 points per trace.

Eye diagram will have 12 X-axis points followed by (12 x ((551 / Number Of Symbols) - 1)) Y-axis points.

Each eye line will consist of 12 Y-axis points combined with the X-axis points that are sent at the beginning.

Please note that this command only works in the dPMR Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: `ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram`

Range: ALL | CONStellation | HISTogram | SPECtrum | EYEDiagram

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

```
:TRACe? SPECtrum
```

Front Panel Access: **NA**

13-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description: Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the dPMR Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm. If the unit is set to Watts, the dPMR Signal Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the dPMR Signal Analyzer received power and squelch setting will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the receiver units to watts:

`:UNIT:POWer:RX WATT`

Front Panel Access: **Amplitude**, Units, Rx Units

:UNIT:POWer:TX DBM|WATT|VOLTs
:UNIT:POWer:TX?

Description: Sets the generator unit to dBm or Watts or Volts. If the unit is set to dBm, the Tx Output Lvl setting will be set and queried in dBm. If the unit is set to Watts, the Tx Output Lvl setting will be set and queried in fW. If the unit is set to Volts, the Tx Output Lvl will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the generator units to volts:

`:UNIT:POWer:TX VOLT`

Front Panel Access: **Amplitude**, Units, Tx Units

13-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:APPLication:TST?

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

```
:SENSe:APPLication:TST?
```

Front Panel Access: **Shift 8** (System), Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. [:SENSe]:APPLication:TST? must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 shown the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 14 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

```
:APPLication:TST?;:APPLication:TST:RESult?
```

Front Panel Access: **Shift 8** (System), Application Self Test

[:SENSe]:AVERage:COUNt <integer>
[:SENSe]:AVERage:COUNt?

Description: Sets the number of times the numerical values in the dPMR Analyzer Summary window are averaged.

Cmd Parameters: <integer>

Query Parameters: **NA**

Range: 1 to 25

Default Value: 1

Default Unit: **NA**

Example: To set averaging to 15:

`:AVERage:COUNt 15`

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description: Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm.

If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted.

The Received Pwr value in the Summary Table is also affected by changing this value.

The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the external attenuation to 30 dB:

`:CORRection:OFFSet 30`

Front Panel Access: **Amplitude**, Rx Power Offset

[:SENSe]:DM:BWIDth?

Description: Queries the modulation bandwidth. Please note that setting the modulation bandwidth will restart the sweep.

Note: Modulation bandwidth value is set to 6.25 kHz.

Query Parameters: **NA**

Range: 6.25

Default Unit: kHz

Example: To query the modulation bandwidth:

`:DM:BWIDth?`

Front Panel Access: **Setup**, Mod Bandwidth

[:SENSe]:DM:SQUelch <value>
[:SENSe]:DM:SQUelch?

Description: Sets the squelch power level. The squelch is only applied to the dPMR Analyzer Summary window on the front panel and will blank out (--) all summary measurements except for Received Pwr when the received power level is lower than the squelch power setting. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW
or 223.6 mV to 223.61 nV

Default Value: -100 dBm or 100 fW or 2.24 µV

Default Unit: dBm or fW or fV

Example: To set the squelch to -10 dBm:

`:DM:SQUelch -10`

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

```
:FREQuency:CENTer 145000000
```

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:COUPling OFF|ON|0|1
[:SENSe]:FREQuency:COUPling?

Description: Turns on frequency coupling. When frequency coupling is on, the Tx frequency cannot be set directly. The Rx Frequency and coupling offset must be used to set the desired Tx frequency. The Tx frequency will automatically trail the Rx frequency by the frequency coupling offset every time the Rx frequency is set. Please note that turning on frequency coupling will automatically move the Tx frequency to the Rx frequency plus any frequency coupling offset. If the Rx frequency and frequency coupling offset is at a setting where the Tx frequency will be beyond the min/max limits, the instrument will not allow coupling to be turned on. The query command returns the state of the frequency coupling setting. A return value of 1 is ON, and a return value of 0 is OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn Rx/Tx frequency coupling on:

```
:SENSe:FREQuency:COUPling ON
```

Front Panel Access: **Frequency**, Rx/Tx Coupling

[:SENSe]:FREQuency:COUPling:OFFSet <value>
[:SENSe]:FREQuency:COUPling:OFFSet?

Description: Sets the frequency coupling offset. If frequency coupling is on, the Tx frequency will automatically trail the Rx frequency by this amount. Please note that the instrument will prevent any coupling offset setting that will make the Tx frequency go beyond the min/max values. The query returns the current coupling offset in Hz.

Cmd Parameters: `<Value>`

Query Parameters: **NA**

Range: -1000000000 Hz to 1000000000 Hz

Default Value: 0 Hz

Default Unit: Hz

Example: To set coupling offset to 200 MHz:

`:SENSe:FREQuency:COUPling:OFFSet 200000000`

Front Panel Access: **Frequency**, Coupling Offset

[:SENSe]:FREQuency:SPAN 25|50|100|500|1000|5000
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in dPMR Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `25|50|100|500|1000|5000`

Query Parameters: NA

Range: 25|50|100|500|1000|5000

Default Value: 25

Default Unit: kHz

Example: To set the span to 1 MHz:

`:SENSe:FREQuency:SPAN 1000`

Front Panel Access: **Frequency**, Span

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In dPMR Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To adjust range:

`:POWer:RANGe`

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In dPMR Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To turn auto ranging off:

`:POWer:RANGe:AUTO OFF`

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe]:SYMBolspan <value>
[:SENSe]:SYMBolspan?

Description: Sets the symbol span. Please note that this setting only affects the Eye Diagram in the dPMR Analyzer measurement. Please note that setting the symbol span will restart the sweep.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 2 to 5

Default Value: 2

Default Unit: **NA**

Example: To set the symbol span to 4:

```
:SYMBolspan 4
```

Front Panel Access: **Measurement**, dPMR Analyzer, Symbol Span

Chapter 14 — DMR 2 Commands

14-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Description: Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To abort a measurement:

`:ABORt`

Front Panel Access: **NA**

14-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

`:CONFigure?`

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `CONFigure` command or a `MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
`SIGA`	DMR 2 Analyzer
`COV`	DMR 2 Coverage
`BITC`	DMR 2 Bit Capture

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:BITCap

Description: This command configures the DMR 2 Bit Capture measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other. Please note that you must have the Rx pattern set to `VOICe` to set the DMR 2 Bit Capture measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to DMR 2 Bit Capture:

`:CONFigure:BITCap`

Related Command: `:DM:PATTern VOICe`

Front Panel Access: **Measurement**, DMR 2 Bit Capture

:CONFigure:COVerage

Description: This command configures the DMR 2 Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to DMR 2 Coverage:

`:CONFigure:COVerage`

Front Panel Access: **Measurement**, DMR 2 Coverage

:CONFigure:SIGAnalyzer

Description: This command configures the DMR 2 Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to DMR 2 Analyzer:

```
:CONFigure:SIGAnalyzer
```

Front Panel Access: **Measurement**, DMR 2 Analyzer

14-3 :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[:WINDow]:TRACe:SELect?

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

```
:DISPlay:TRACe:SELect?
```

Front Panel Access: **Measurement**, DMR 2 Analyzer, Active Graph

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. In the DMR 2 Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

```
:DISPlay:TRACe:Y:PDIVision 8
```

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the DMR 2 Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Unit: dBm

Example: To set the reference level to -40:

`:DISPlay:TRACe:Y:RLEVel -40`

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, BER, and Mod Fid data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|BER|MODFid`

The query version of this command returns "RSSI" if the mapping type is set to RSSI, "BER" if set to BER, and "MODF" if set to Mod Fid.

Please note that this command only works when the current measurement is set to DMR 2 Coverage. Refer to the Related Command below.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|BER|MODFid

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to Mod Fid:

`:DISPlay:TRACe:FORMat:COVerage MODFid`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, DMR 2 Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`CONStellation|SPECtrum|HISTogram|SUMMary|DMR2summary|EYEDiagram|LINConstellation|PROFile`

The query version of this command returns "CONS" if the specified trace graph type is set to Constellation, "HIST" if set to Histogram, "SPEC" if set to Spectrum, "SUMM" if set to Summary, "DMR2" if set to DMR 2 Summary, "EYED" if set to Eye Diagram, "LINC" if set to linear constellation, and "PROF" if set to power profile.

Please note that this command only works when the current measurement is set to DMR 2 Analyzer.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: CONStellation | SPECtrum | HISTogram | SUMMary | DMR2summary | EYEDiagram | LINConstellation | PROFile

Default Value: Trace 1: Linear Constellation
Trace 2: Spectrum
Trace 3: Histogram
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Eye Diagram:

`:DISPlay:TRACe2:FORMat:SIGAnalyzer EYEDiagram`

Related Command: :CONFigure:SIGAnalyzer

Front Panel Access: **Measurement**, DMR 2 Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, <Tr>, as the active trace. <Tr> is the trace number in the range 1 to 4 for DMR 2 Analyzer. If no trace number is specified, then the <Tr> parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

`:DISPlay:TRACe2:SELect`

Front Panel Access: **Measurement**, DMR 2 Analyzer, Active Graph

14-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent DMR 2 Coverage numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch DMR 2 Coverage numerical data:

`:FETCh:COVerage?`

Related Command: :CONFigure:COVerage

Front Panel Access: **NA**

:FETCh:SIGAnalyzer?

Description: Returns the most recent DMR 2 Analyzer numerical measurement results.

For firmware v1.13 and prior, data is returned as 14 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)
Source Address (as integer)
FLCO (as integer)
CSBKO (as integer)
FID (as integer)
Target ID (as integer)
Talk group ID (as integer)
Base Station ID (as integer)

For firmware v1.14 and later, data is returned as 13 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)
Source UID (as integer)
Target ID (as integer)
Talk Group ID (as integer)
FID (as integer)
Call Type (as char)
Base Station ID (as integer)

If there is no valid measurement data, the instrument will return "--" in that field.

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch DMR 2 Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

14-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format.
The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to “Interpreting Returned Data” on page 14-13 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

```
:FORMat INTeger,32
```

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL | CONStellation | HISTogram | PROFile | SPECtrum | EYEDiagram" command on page 14-37.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. For example, *<CONSTELLATION>* is *15* bytes. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum and Histogram datapoints consists of 4 bytes.
- Eye Diagram datapoints [12 X-axis points and (12 x ((551 / Number Of Symbols) - 1)) Y-axis points] are 4 bytes each.
- Each Constellation datapoint consists of 8 bytes.
  - The first 4 bytes are the I component
  - The next 4 bytes are the Q component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

  Converting INTeger,32 Example:

  The instrument returns the following Spectrum data point in INT,32 format:

  b9 c0 fd ff

  1. Convert from little endian to big endian:

     ff fd c0 b9

  2. Since the MSb in both components is 1, they are negative numbers.
  3. The binary representation is:

     11111111111111011100000010111001

  4. Convert from two's complement (not the bits and add 1):

     100011111101000111

  5. Convert the binary values to decimal:

     147271

  6. Take out the 1e3 scale factor:

     147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:

   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

14-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

14-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to DMR 2 Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure DMR 2 Coverage numerical data:

`:MEASure:COVerage?`

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to DMR 2 Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

For firmware v1.13 and prior, data is returned as 14 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)
Source Address (as integer)
FLCO (as integer)
CSBKO (as integer)
FID (as integer)
Target ID (as integer)
Talk group ID (as integer)
Base Station ID (as integer)

For firmware v1.14 and later, data is returned as 13 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)
Source UID (as integer)
Target ID (as integer)
Talk Group ID (as integer)
FID (as integer)
Call Type (as char)
Base Station ID (as integer)

If there is no valid measurement data, the instrument will return "--" in that field.

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: The `squelch` setting `[:SENSe]:DM:SQUelch` will blank out (--) all summary measurements on the instrument display except for Received Pwr when the received power level is lower than the squelch power setting. The received power level is also affected by the Rx Power Offset setting. The query command will still return values even if the instrument display is blanked out.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure DMR 2 Analyzer numerical data:

`:MEASure:SIGAnalyzer?`

Front Panel Access: **NA**

14-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a setup file:

`:MMEMory:LOAD:STATe 1,"xxx.stp"`

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use `:INSTrument:SELect` or `:INSTrument:NSELect` to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by `<filename>` should be available at the current save location. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

"`.spa`" for SPA measurement
"`.mna`" for VNA and VVM measurements
"`.hipm`" for HiPM measurements
"`.pm`" for PM measurements
"`.cwsg`" for CWSG measurements
"`.afp`" for AM/FM/PM measurements
"`.ia`" for Interference Analysis measurements
"`.cs`" for Channel Scanner measurements
"`.wmxd`" for WiMAX
"`.wmxe`" for Mobile WiMAX

"`.lte`" for LTE measurements
"`.p25`" for P25 measurements
"`.p252`" for P25p2 measurements
"`.nxdn`" for NXDN measurements
"`.dpmr`" for dPMR measurements
"`.dmr2`" for DMR 2 measurements
"`.ptc`" for PTC measurements
"`.tetra`" for TETRA measurements
"`.nbfm`" for NBFM measurements

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

`:MMEMory:LOAD:TRACe 1,"xxx.dmr2"`

Front Panel Access: **Shift 7** (File), Recall Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be recalled on the instrument.

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a setup file:

`:MMEMory:STORe:STATe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a measurement file:

`:MMEMory:STORe:TRACe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save Measurement

Note	Control Channel, Bit Capture and IQ Data measurements can not be saved on the instrument.

14-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new DMR 2 Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT`; `:INITiate`; `:FETCh:COVerage?` DMR 2 Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read DMR 2 Coverage numerical data:

`:READ:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new DMR 2 Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT;` `:INITiate;` `:FETCh:SIGAnalyzer?`

DMR 2 Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?`

For firmware v1.13 and prior, data is returned as 14 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)
Source Address (as integer)
FLCO (as integer)
CSBKO (as integer)
FID (as integer)
Target ID (as integer)
Talk group ID (as integer)
Base Station ID (as integer)

For firmware v1.14 and later, data is returned as 13 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
CC (hex)
Symbol Rate Error (Hz as float)
Source UID (as integer)
Target ID (as integer)
Talk Group ID (as integer)
FID (as integer)
Call Type (as char)
Base Station ID (as integer)

If there is no valid measurement data, the instrument will return “--” in that field.

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read DMR 2 Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

14-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the DMR 2 signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

```
:SOURce:CORRection:OFFSet -10
```

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

```
:SOURce:DM:PATTern 2
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format:

Base Station Mod Type:

0: dmr2_bs_1031
1: dmr2_bs_511(O.153)
2: dmr2_bs_silence
3: dmr2_bs_1031_1_pcnt_ber
4: dmr2_bs_511(O.153)_1_pcnt_ber
5: dmr2_bs_tscc
6: cw
7: am_1khz_audio
8: fm_1khz_audio

Mobile Station Mod Type:

0: dmr2_ms_1031
1: dmr2_ms_511(O.153)
2: dmr2_ms_silence
3: dmr2_ms_1031_1_pcnt_ber
4: dmr2_ms_511(O.153)_1_pcnt_ber
5: cw
6: am_1khz_audio
7: fm_1khz_audio

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

`:SOURce:DM:PATTern:LIST?`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

```
:SOURce:FREQuency:CENTer 145000000
```

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the DMR 2 signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or 70710678 fV to 223606797749978 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

```
:SOURce:POWer -10
```

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

`:SOURce:STATe ON`

Front Panel Access: **Turn Sig-Gen ON/OFF**

14-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "NAME=VALUE[UNITS]". Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 14-1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To get the trace preamble:

```
:TRACe:PREamble?
```

Front Panel Access: **NA**

Table 14-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.

Table 14-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style).
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.

Table 14-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.

Table 14-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).

Table 14-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 14-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).

Table 14-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Not used.
SYSTEM_ID	Not used.
COLOR_CODE	Not used.

:TRACe[:DATA]? ALL|CONStellation|HISTogram|PROFile|SPECtrum|EYEDiagram

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by `:FORMat:DATA`. Trace setup information can be acquired using `:TRACe[:DATA]:PREamble?` Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
<CONSTELLATION>	</CONSTELLATION>
<HISTOGRAM>	</HISTOGRAM>
<POWER_PROFILE>	</POWER_PROFILE>
<SPECTRUM>	</SPECTRUM>
<EYE_DIAGRAM>	</EYE_DIAGRAM>

The tags listed above will always show up in the response and will always be in the order described.

Constellation data will have two elements per point. There will be 551 constellation points total.

Spectrum, histogram, and power profile data will only have one element per point. There will also only be 551 points per trace.

Eye diagram will have 12 X-axis points followed by (12 x ((551 / Number Of Symbols) - 1)) Y-axis points.

Each eye line will consist of 12 Y-axis points combined with the X-axis points that are sent at the beginning.

Please note that this command only works in the DMR 2 Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: `ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram`

Range: ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

```
:TRACe? SPECtrum
```

Front Panel Access: **NA**

14-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description:	Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the DMR 2 Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm. If the unit is set to Watts, the DMR 2 Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the DMR 2 Analyzer received power and squelch setting will be set and queried in fV.
Cmd Parameters:	DBM|WATT|VOLTs
Query Parameters:	**NA**
Range:	DBM|WATT|VOLTs
Default Value:	DBM
Default Unit:	**NA**
Example:	To set the receiver units to watts: `:UNIT:POWer:RX WATT`
Front Panel Access:	**Amplitude**, Units, Rx Units

:UNIT:POWer:TX DBM|WATT|VOLT
:UNIT:POWer:TX?

Description:	Sets the generator unit to dBm or Watts or Volts. If the unit is set to dBm, the Tx Output Lvl setting will be set and queried in dBm. If the unit is set to Watts, the Tx Output Lvl setting will be set and queried in fW. If the unit is set to Volts, the Tx Output Lvl will be set and queried in fV.
Cmd Parameters:	DBM|WATT|VOLTs
Query Parameters:	**NA**
Range:	DBM|WATT|VOLTs
Default Value:	DBM
Default Unit:	**NA**
Example:	To set the generator units to volts: `:UNIT:POWer:TX VOLT`
Front Panel Access:	**Amplitude**, Units, Tx Units

14-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

`[:SENSe]:APPLication:TST?`

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

`:SENSe:APPLication:TST?`

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. [:SENSe]:APPLication:TST? must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 show the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 18 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

```
:APPLication:TST?;:APPLication:TST:RESult?
```

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:AVERage:COUNt <integer>
[:SENSe]:AVERage:COUNt?

Description: Sets the number of times the numerical values in the DMR 2 Analyzer Summary window are averaged. Please note that CC is not averaged.

Cmd Parameters: <integer>

Query Parameters: **NA**

Range: 1 to 25

Default Value: 1

Default Unit: **NA**

Example: To set averaging to 15:

`:AVERage:COUNt 15`

Front Panel Access: **Setup**, Averaging

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description: Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm.

If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted.

The Received Pwr value in the Summary Table is also affected by changing this value.

The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the external attenuation to 30 dB:

`:CORRection:OFFSet 30`

Front Panel Access: **Amplitude**, Rx Power Offset

[:SENSe]:DM:SQUelch <value>
[:SENSe]:DM:SQUelch?

Description: Sets the squelch power level. The squelch is only applied to the DMR 2 Analyzer Summary window on the front panel and will blank out (--) all summary measurements except for Received Pwr when the received power level is lower than the squelch power setting. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: NA

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW or 223.6 mV to 223.61 nV

Default Value: -100 dBm or 100 fW or 2.24 µV

Default Unit: dBm or fW or fV

Example: To set the squelch to -10 dBm:

```
:DM:SQUelch -10
```

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:DM:FORMat BS|MS
[:SENSe]:DM:FORMat?

Description: Sets the modulation type. The query will return BS (for Base Station) and MS (for Mobile Station). Please note that setting the modulation type will restart the sweep.

Cmd Parameters: `BS|MS`

Query Parameters: **NA**

Range: `BS|MS`

Default Value: BS

Default Unit: **NA**

Example: To set the modulation type to Mobile Station:

`:DM:FORMat MS`

Front Panel Access: **Setup**, Mod Type

[:SENSe]:DM:PATTern 1031hz|O.153|VOICe|CTRLchan|SILence|IDLE
[:SENSe]:DM:PATTern?

Description: Sets the receiver pattern type. Please note that setting the Rx Pattern will restart the sweep.

Cmd Parameters: `1031hz|O.153|VOICe|CTRLchan|SILence|IDLE`

Query Parameters: **NA**

Range: 1031hz|O.153|VOICe|CTRLchan|SILence|IDLE

Default Value: 1031hz

Default Unit: **NA**

Example: To set the modulation type to voice:

`:DM:PATTern VOICe`

Front Panel Access: **Setup**, Rx Pattern

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

`:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:COUPling OFF|ON|0|1
[:SENSe]:FREQuency:COUPling?

Description: Turns on frequency coupling. When frequency coupling is on, the Tx frequency cannot be set directly. The Rx Frequency and coupling offset must be used to set the desired Tx frequency. The Tx frequency will automatically trail the Rx frequency by the frequency coupling offset every time the Rx frequency is set. Please note that turning on frequency coupling will automatically move the Tx frequency to the Rx frequency plus any frequency coupling offset. If the Rx frequency and frequency coupling offset is at a setting where the Tx frequency will be beyond the min/max limits, the instrument will not allow coupling to be turned on. The query command returns the state of the frequency coupling setting. A return value of 1 is ON, and a return value of 0 is OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn Rx/Tx frequency coupling on:

`:SENSe:FREQuency:COUPling ON`

Front Panel Access: **Frequency**, Rx/Tx Coupling

[:SENSe]:FREQuency:COUPling:OFFSet <value>
[:SENSe]:FREQuency:COUPling:OFFSet?

Description: Sets the frequency coupling offset. If frequency coupling is on, the Tx frequency will automatically trail the Rx frequency by this amount. Please note that the instrument will prevent any coupling offset setting that will make the Tx frequency go beyond the min/max values. The query returns the current coupling offset in Hz.

Cmd Parameters: `<Value>`

Query Parameters: **NA**

Range: -1000000000 Hz to 1000000000 Hz

Default Value: 0 Hz

Default Unit: Hz

Example: To set coupling offset to 200 MHz:

```
:SENSe:FREQuency:COUPling:OFFSet 200000000
```

Front Panel Access: **Frequency**, Coupling Offset

[:SENSe]:FREQuency:SPAN 25|50|100|500|1000|5000
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in DMR 2 Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `25|50|100|500|1000|5000`

Query Parameters: NA

Range: 25|50|100|500|1000|5000

Default Value: 25

Default Unit: kHz

Example: To set the span to 1 MHz:

```
:SENSe:FREQuency:SPAN 1000
```

Front Panel Access: **Frequency**, Span

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In DMR 2 Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: NA

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To adjust range:

`:POWer:RANGe`

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In DMR 2 Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: NA

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: NA

Example: To turn auto ranging off:

`:POWer:RANGe:AUTO OFF`

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe]:SYMBolspan <value>
[:SENSe]:SYMBolspan?

Description: Sets the symbol span. Please note that this setting only affects the Eye Diagram in the DMR 2 Analyzer measurement. Please note that setting the symbol span will restart the sweep.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 2 to 5

Default Value: 2

Default Unit: **NA**

Example: To set the symbol span to 4:

```
:SYMBolspan 4
```

Front Panel Access: **Measurement**, DMR 2 Analyzer, Symbol Span

Chapter 15 — PTC Commands

15-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Description: Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To abort a measurement:

```
:ABORt
```

Front Panel Access: **NA**

15-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

:CONFigure?

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `:CONFigure` command or a `:MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
`SIGA`	PTC Analyzer
`COV`	PTC Coverage

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:COVerage

Description: This command configures the PTC Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to PTC Coverage:

`:CONFigure:COVerage`

Front Panel Access: **Measurement**, PTC Coverage

:CONFigure:SIGAnalyzer

Description: This command configures the PTC Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to PTC Analyzer:

`:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, PTC Analyzer

15-3 :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[:WINDow]:TRACe:SELect?

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

`:DISPlay:TRACe:SELect?`

Front Panel Access: **Measurement**, PTC Analyzer, Active Graph

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. In the PTC Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

`:DISPlay:TRACe:Y:PDIVision 8`

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the PTC Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Unit: dBm

Example: To set the reference level to -40:

`:DISPlay:TRACe:Y:RLEVel -40`

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, BER, and Mod Fid data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|BER|MODFid`

The query version of this command returns `"RSSI"` if the mapping type is set to RSSI, `"BER"` if set to BER, and `"MODF"` if set to Mod Fid.

Please note that this command only works when the current measurement is set to PTC Coverage. Refer to the Related Command below.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|BER|MODFid

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to Mod Fid:

`:DISPlay:TRACe:FORMat:COVerage MODFid`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, PTC Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`CONStellation|SPECtrum|HISTogram|SUMMary|EYEDiagram|LINConstellation`

The query version of this command returns "CONS" if the specified trace graph type is set to Constellation, "HIST" if set to Histogram, "SPEC" if set to Spectrum, "SUMM" if set to Summary, "EYED" if set to Eye Diagram, and "LINC" if set to linear constellation.

Please note that this command only works when the current measurement is set to PTC Analyzer.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: CONStellation | SPECtrum | HISTogram | SUMMary | EYEDiagram | LINConstellation

Default Value: Trace 1: Linear Constellation
Trace 2: Spectrum
Trace 3: Histogram
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Eye Diagram:

```
:DISPlay:TRACe2:FORMat:SIGAnalyzer EYEDiagram
```

Related Command: :CONFigure:SIGAnalyzer

Front Panel Access: **Measurement**, PTC Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4 for PTC Analyzer. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

```
:DISPlay:TRACe2:SELect
```

Front Panel Access: **Measurement**, PTC Analyzer, Active Graph

15-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent PTC Coverage numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch PTC Coverage numerical data:

`:FETCh:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:FETCh:SIGAnalyzer?

Description: Data is returned as 8 comma-separated values in the following order and format.

When the modulation type is set to 4FSK
(`[:SENSe]:DM:FORMat 4FSK`):
Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
Symbol Rate Error (Hz as float)

When the modulation type is set to DQPSK
(`[:SENSe]:DM:FORMat DQPSK`):
Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
EVM (% as float)
BER (% as float)
IQ Imbalance (dB as float)
Symbol Rate Error (Hz as float)
Phase Error (degree as float)
Mag Error (% as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch PTC Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

15-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to “Interpreting Returned Data” on page 15-10 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

```
:FORMat INTeger,32
```

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL | CONStellation | HISTogram | SPECtrum | EYEDiagram" command on page 15-35.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. For example, *<CONSTELLATION>* is *15* bytes. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum and Histogram datapoints consists of 4 bytes.
- Eye Diagram datapoints [12 X-axis points and (12 x ((551 / Number Of Symbols) - 1)) Y-axis points] are 4 bytes each.
- Each Constellation datapoint consists of 8 bytes.
  - The first 4 bytes are the I component
  - The next 4 bytes are the Q component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

  Converting INTeger,32 Example:

  The instrument returns the following Spectrum data point in INT,32 format:

  b9 c0 fd ff

  1. Convert from little endian to big endian:

     ff fd c0 b9

  2. Since the MSb in both components is 1, they are negative numbers.
  3. The binary representation is:

     11111111111111011100000010111001

  4. Convert from two's complement (not the bits and add 1):

     100011111101000111

  5. Convert the binary values to decimal:

     147271

  6. Take out the 1e3 scale factor:

     147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:
   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

15-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

15-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to PTC Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure PTC Coverage numerical data:

```
:MEASure:COVerage?
```

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to PTC Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

Data is returned as 8 comma-separated values in the following order and format.

When the modulation type is set to 4FSK (`[:SENSe]:DM:FORMat 4FSK`):
Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
Symbol Rate Error (Hz as float)

When the modulation type is set to DQPSK (`[:SENSe]:DM:FORMat DQPSK`):
Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
EVM (% as float)
BER (% as float)
IQ Imbalance (dB as float)
Symbol Rate Error (Hz as float)
Phase Error (degree as float)
Mag Error (% as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: The `squelch` setting `[:SENSe]:DM:SQUelch` will blank out (--) all summary measurements on the instrument display except for Received Pwr when the received power level is lower than the squelch power setting. The received power level is also affected by the Rx Power Offset setting. The query command will still return values even if the instrument display is blanked out.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure PTC Analyzer numerical data:

`:MEASure:SIGAnalyzer?`

Front Panel Access: **NA**

15-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a setup file:

```
:MMEMory:LOAD:STATe 1,"xxx.stp"
```

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use :INSTrument:SELect or :INSTrument:NSELect to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by <filename>. <filename> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by <filename> should be available at the current save location. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

".spa" for SPA measurement
".mna" for VNA and VVM measurements
".hipm" for HiPM measurements
".pm" for PM measurements
".cwsg" for CWSG measurements
".afp" for AM/FM/PM measurements
".ia" for Interference Analysis measurements
".cs" for Channel Scanner measurements
".wmxd" for WiMAX
".wmxe" for Mobile WiMAX

“.lte” for LTE measurements
“.p25” for P25 measurements
“.p252” for P25p2 measurements
“.nxdn” for NXDN measurements
“.dpmr” for dPMR measurements
“.dmr2” for DMR 2 measurements
“.ptc” for PTC measurements
“.tetra” for TETRA measurements
“.nbfm” for NBFM measurements

Cmd Parameters: <integer>,<filename>

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

`:MMEMory:LOAD:TRACe 1,"xxx.ptc"`

Front Panel Access: **Shift 7** (File), Recall Measurement

Note	IQ Data measurements can not be recalled on the instrument.

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by <filename>. <filename> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: <integer>,<filename>

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a setup file:

`:MMEMory:STORe:STATe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a measurement file:

`:MMEMory:STORe:TRACe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save Measurement

Note	IQ Data measurements can not be saved on the instrument.

15-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new PTC Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT`; `:INITiate`; `:FETCh:COVerage?` PTC Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
Mod Fid (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read PTC Coverage numerical data:

`:READ:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new PTC Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT`; `:INITiate`; `:FETCh:SIGAnalyzer?`

PTC Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?`

Data is returned as 8 comma-separated values in the following order and format.

When the modulation type is set to 4FSK (`[:SENSe]:DM:FORMat 4FSK`):
Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
Mod Fid (% as float)
BER (% as float)
Symbol Dev (Hz as float)
Symbol Rate Error (Hz as float)

When the modulation type is set to DQPSK (`[:SENSe]:DM:FORMat DQPSK`):
Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
EVM (% as float)
BER (% as float)
IQ Imbalance (dB as float)
Symbol Rate Error (Hz as float)
Phase Error (degree as float)
Mag Error (% as float)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read PTC Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

15-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the PTC signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

```
:SOURce:CORRection:OFFSet -10
```

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

```
:SOURce:DM:PATTern 2
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format:

4FSK, Symbol Rate 6000:
0: ptc_4fsk_Pattern0_6000
1: ptc_4fsk_Pattern1_6000
2: ptc_4fsk_Pattern2_6000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

4FSK, Symbol Rate 8000:
0: ptc_4fsk_Pattern0_8000
1: ptc_4fsk_Pattern1_8000
2: ptc_4fsk_Pattern2_8000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

4FSK, Symbol Rate 12000:
0: ptc_4fsk_Pattern0_12000
1: ptc_4fsk_Pattern1_12000
2: ptc_4fsk_Pattern2_12000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

4FSK, Symbol Rate 16000:
0: ptc_4fsk_Pattern0_16000
1: ptc_4fsk_Pattern1_16000
2: ptc_4fsk_Pattern2_16000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

4FSK, Symbol Rate 18000:
0: ptc_4fsk_Pattern0_18000
1: ptc_4fsk_Pattern1_18000
2: ptc_4fsk_Pattern2_18000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

DQPSK, Symbol Rate 6000:
0: ptc_dqpsk_Pattern0_6000
1: ptc_dqpsk_Pattern1_6000
2: ptc_dqpsk_Pattern2_6000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

DQPSK, Symbol Rate 8000:
0: ptc_dqpsk_Pattern0_8000
1: ptc_dqpsk_Pattern1_8000
2: ptc_dqpsk_Pattern2_8000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

DQPSK, Symbol Rate 12000:
0: ptc_dqpsk_Pattern0_12000
1: ptc_dqpsk_Pattern1_12000
2: ptc_dqpsk_Pattern2_12000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

DQPSK, Symbol Rate 16000:
0: ptc_dqpsk_Pattern0_16000
1: ptc_dqpsk_Pattern1_16000
2: ptc_dqpsk_Pattern2_16000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

DQPSK, Symbol Rate 18000:
0: ptc_dqpsk_Pattern0_18000
1: ptc_dqpsk_Pattern1_18000
2: ptc_dqpsk_Pattern2_18000
3: cw
4: am_1khz_audio
5: fm_1khz_audio

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

`:SOURce:DM:PATTern:LIST?`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

`:SOURce:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the PTC signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or 70710678 fV to 223606797749978 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

`:SOURce:POWer -10`

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

`:SOURce:STATe ON`

Front Panel Access: **Turn Sig-Gen ON/OFF**

15-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the `MMEMory` subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as `"NAME=VALUE[UNITS]"`. Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 15-1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To get the trace preamble:

`:TRACe:PREamble?`

Front Panel Access: **NA**

Table 15-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.

Table 15-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style).
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.

Table 15-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.

Table 15-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).

Table 15-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 15-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).

Table 15-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Not used.
SYSTEM_ID	Not used.
COLOR_CODE	Not used.

:TRACe[:DATA]? ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by `:FORMat:DATA`. Trace setup information can be acquired using `:TRACe[:DATA]:PREamble?` Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
`<CONSTELLATION>`	`</CONSTELLATION>`
`<HISTOGRAM>`	`</HISTOGRAM>`
`<SPECTRUM>`	`</SPECTRUM>`
`<EYE_DIAGRAM>`	`</EYE_DIAGRAM>`

The tags listed above will always show up in the response and will always be in the order described.

Constellation data will have two elements per point. There will be 551 constellation points total.

Spectrum and histogram data will only have one element per point. There will also only be 551 points per trace.

Eye diagram will have 12 X-axis points followed by (12 x ((551 / Number Of Symbols) - 1)) Y-axis points.

Each eye line will consist of 12 Y-axis points combined with the X-axis points that are sent at the beginning.

Please note that this command only works in the PTC Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: `ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram`

Range: ALL|CONStellation|HISTogram|SPECtrum|EYEDiagram

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

`:TRACe? SPECtrum`

Front Panel Access: **NA**

15-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description: Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the PTC Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm.If the unit is set to Watts, the PTC Signal Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the PTC Signal Analyzer received power and squelch setting will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the receiver units to watts:

```
:UNIT:POWer:RX WATT
```

Front Panel Access: **Amplitude**, Units, Rx Units

:UNIT:POWer:TX DBM|WATT|VOLTs
:UNIT:POWer:TX?

Description: Sets the generator unit to dBm or Watts or Volts. If the unit is set to dBm, the Tx Output Lvl setting will be set and queried in dBm. If the unit is set to Watts, the Tx Output Lvl setting will be set and queried in fW. If the unit is set to Volts, the Tx Output Lvl will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the generator units to volts:

```
:UNIT:POWer:TX VOLT
```

Front Panel Access: **Amplitude**, Units, Tx Units

15-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:APPLication:TST?

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

`:APPLication:TST?`

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. `[:SENSe]:APPLication:TST?` must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 show the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 14 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

`:APPLication:TST?;:APPLication:TST:RESult?`

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:AVERage:COUNt <integer>
[:SENSe]:AVERage:COUNt?

Description: Sets the number of times the numerical values in the PTC Analyzer Summary window are averaged.

Cmd Parameters: <integer>

Query Parameters: **NA**

Range: 1 to 25

Default Value: 1

Default Unit: **NA**

Example: To set averaging to 15:

```
:AVERage:COUNt 15
```

Front Panel Access: **Setup**, Averaging

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description: Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm.

If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted.

The Received Pwr value in the Summary Table is also affected by changing this value.

The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the external attenuation to 30 dB:

```
:CORRection:OFFSet 30
```

Front Panel Access: **Amplitude**, Rx Power Offset

[:SENSe]:DM:FORMat 4FSK|DQPSK
[:SENSe]:DM:FORMat?

Description: Sets the modulation type. The query will return 4FSK for 4FSK and DQPS for DSPSK. Please note that setting the modulation type will restart the sweep.

Cmd Parameters: `4FSK|DQPSK`

Query Parameters: **NA**

Range: 4FSK|DQPSK

Default Value: 4FSK

Default Unit: **NA**

Example: To set the modulation type to DQPSK:

`:DM:FORMat DQPSK`

Front Panel Access: **Setup**, Mod Type

[:SENSe]:DM:SQUelch <value>
[:SENSe]:DM:SQUelch?

Description: Sets the squelch power level. The squelch is only applied to the PTC Analyzer Summary window on the front panel and will blank out (--) all summary measurements except for Received Pwr when the received power level is lower than the squelch power setting. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: NA

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW or 223.6 mV to 223.61 nV

Default Value: -100 dBm or 100 fW or 2.24 µV

Default Unit: dBm or fW or fV

Example: To set the squelch to -10 dBm:

`:DM:SQUelch -10`

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:DM:SYMBol:RATE 6000|8000|12000|16000|18000
[:SENSe]:DM:SYMBol:RATE?

Description: Sets the symbol rate of the signal generator.

Cmd Parameters: `6000|8000|12000|16000|18000`

Query Parameters: **NA**

Range: 6000|8000|12000|16000|18000

Default Value: 6000

Default Unit: **NA**

Example: To set the symbol rate to 16000:

`:DM:SYMBol 16000`

Front Panel Access: **Setup**, Symbol Rate

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

```
:FREQuency:CENTer 145000000
```

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:COUPling OFF|ON|0|1
[:SENSe]:FREQuency:COUPling?

Description: Turns on frequency coupling. When frequency coupling is on, the Tx frequency cannot be set directly. The Rx Frequency and coupling offset must be used to set the desired Tx frequency. The Tx frequency will automatically trail the Rx frequency by the frequency coupling offset every time the Rx frequency is set. Please note that turning on frequency coupling will automatically move the Tx frequency to the Rx frequency plus any frequency coupling offset. If the Rx frequency and frequency coupling offset is at a setting where the Tx frequency will be beyond the min/max limits, the instrument will not allow coupling to be turned on. The query command returns the state of the frequency coupling setting. A return value of 1 is ON, and a return value of 0 is OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn Rx/Tx frequency coupling on:

```
:SENSe:FREQuency:COUPling ON
```

Front Panel Access: **Frequency**, Rx/Tx Coupling

[:SENSe]:FREQuency:COUPling:OFFSet <value>
[:SENSe]:FREQuency:COUPling:OFFSet?

Description: Sets the frequency coupling offset. If frequency coupling is on, the Tx frequency will automatically trail the Rx frequency by this amount. Please note that the instrument will prevent any coupling offset setting that will make the Tx frequency go beyond the min/max values.
The query returns the current coupling offset in Hz.

Cmd Parameters: `<Value>`

Query Parameters: **NA**

Range: -1000000000 Hz to 1000000000 Hz

Default Value: 0 Hz

Default Unit: Hz

Example: To set coupling offset to 200 MHz:

```
:SENSe:FREQuency:COUPling:OFFSet 200000000
```

Front Panel Access: **Frequency**, Coupling Offset

[:SENSe]:FREQuency:SPAN 25|50|100|500|1000|5000
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in PTC Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `25|50|100|500|1000|5000`

Query Parameters: NA

Range: 25|50|100|500|1000|5000

Default Value: 25

Default Unit: kHz

Example: To set the span to 1 MHz:

```
:SENSe:FREQuency:SPAN 1000
```

Front Panel Access: **Frequency**, Span

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In PTC Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To adjust range:

`:POWer:RANGe`

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In PTC Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To turn auto ranging off:

`:POWer:RANGe:AUTO OFF`

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe]:SYMBolspan <value>
[:SENSe]:SYMBolspan?

Description: Sets the symbol span. Please note that this setting only affects the Eye Diagram in the PTC Analyzer measurement. Please note that setting the symbol span will restart the sweep.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 2 to 5

Default Value: 2

Default Unit: **NA**

Example: To set the symbol span to 4:

`:SYMBolspan 4`

Front Panel Access: **Measurement**, PTC Analyzer, Symbol Span

Chapter 16 — NBFM Commands

16-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Description:	Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.
Cmd Parameters:	**NA**
Query Parameters:	**NA**
Range:	**NA**
Default Value:	**NA**
Default Unit:	**NA**
Example:	To abort a measurement: `:ABORt`
Front Panel Access:	**NA**

16-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

`:CONFigure?`

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `CONFigure` command or a `MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
`SIGA`	NBFM Analyzer
`COV`	NBFM Coverage
`QUI`	NBFM Quieting
`SNDR`	NBFM SINAD

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:COVerage

Description: This command configures the NBFM Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NBFM Coverage:

`:CONFigure:COVerage`

Front Panel Access: **Measurement**, NBFM Coverage

:CONFigure:QUIeting

Description: This command configures the NBFM Quieting measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NBFM Quieting:

`:CONFigure:QUIeting`

Front Panel Access: **Measurement**, NBFM Quieting

:CONFigure:SIGAnalyzer

Description: This command configures the NBFM Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NBFM Analyzer:

`:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, NBFM Analyzer

:CONFigure:SNDRatio

Description: This command configures the NBFM SINAD measurement.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to NBFM SINAD:

`:CONFigure:SNDRatio`

Front Panel Access: **Measurement**, NBFM SINAD

16-3 :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[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, THD, SINAD, and External SINAD data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|THD|SINad|EXTS`

The query version of this command returns "RSSI" if the mapping type is set to RSSI, "THD" if set to THD, "SIN" if set to SINAD, and "EXTS" if set to External SINAD.

Please note that this command only works when the current measurement is set to NBFM Coverage. Refer to the Related Command.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|THD|SINad|EXTS

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to SINAD:

`:DISPlay:TRACe:FORMat:COVerage SINad`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, NBFM Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe:SELect?

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

`:DISPlay:TRACe:SELect?`

Front Panel Access: **Measurement**, NBFM Analyzer, Active Graph

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:IFPercent <Percentage>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:IFPercent?

Description: Sets the IF bandwidth percent. This setting adjusts the Y-Axis scale for the Audio Spectrum and Audio Waveform graphs in the NBFM Analyzer measurement mode.

Cmd Parameters: `<Percentage>`

Query Parameters: **NA**

Range: 1% to 100%

Default Value: 50.00

Default Unit: **NA**

Example: To change the IF Bandwidth % to 30%:

`:DISPlay:TRACe:Y:IFPercent 30.00`

Front Panel Access

Front Panel Access: **Setup**, Filters, % IFBW

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. In the NBFM Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

`:DISPlay:TRACe:Y:PDIVision 8`

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the NBFM Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Value: 0 dBm

Default Unit: dBm

Example: To set the reference level to -40:

```
:DISPlay:TRACe:Y:RLEVel -40
```

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`SPECtrum|ASPEctrum|AWAVeform|SUMMary`

The query version of this command returns "SPEC" if the specified trace graph type is set to Spectrum, "ASPE" if set to Audio Spectrum, "AWAV" if set to Audio Waveform, and "SUMM" if set to Summary.

Please note that this command only works when the current measurement is set to NBFM Analyzer. Refer to the Related Command below.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: SPECtrum | ASPEctrum | AWAVeform | SUMMary

Default Value: Trace 1:Spectrum
Trace 2: Audio Spectrum
Trace 3: Audio Waveform
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Audio Waveform:

`:DISPlay:TRACe2:FORMat:SIGAnalyzer AWAVeform`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **Measurement**, NBFM Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4 for NBFM Analyzer. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

`:DISPlay:TRACe2:SELect`

Front Panel Access: **Measurement**, NBFM Analyzer, Active Graph

16-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement mode.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent NBFM Coverage numerical measurement results. Note that this command only functions in the NBFM measurement mode and when the instrument has a valid GPS lock.

Data is returned as 8comma-separated values in the following order and format:

RSSI (dBm as float)
THD (% as float)
SINAD (dB as float)
ExtSINAD (dB as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch NBFM Coverage numerical data:

`:FETCh:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:FETCh:QUIeting?

Description: Returns the most recent NBFM Quieting numerical measurement results.

Data is returned as 2 comma-separated values in the following order and format:

Measured Voltage (float), Reference Voltage (float).

If there is no valid measurement data, the instrument will return "--,--".

Please note that this command only works when the current measurement is set to NBFM Quieting. Refer to the Related Command below.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch NBFM Quieting numerical data:

`:FETCh:QUIeting?`

Related Command: `:CONFigure:QUIeting`

Front Panel Access: NA

:FETCh:SIGAnalyzer?

Description: Returns the most recent NBFM Analyzer numerical measurement results. Data is returned as 10 comma-separated values in the following order and format:

Carrier Power (dBm as float or Watts as long long int or Volts as long long int)
Carrier Frequency (Hz as float)
Deviation (Hz as float)
Mod Rate (Hz as float)
SINAD (dB as float)
THD (% as float)
Occ BW (Hz as float)
ExtSINAD (dB as float)
CTCSS (string)
DCS (string)
DTMF (string)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--,--,--,--".

Please note that the received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command `:UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Also note that only one of the last three numerical values will be shown. The other two values will be dashed out. This is done because only one tone type can be chosen at any given time.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch NBFM Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

:FETCh:SNDRatio?

Description: Returns the most recent NBFM SINAD numerical measurement results.

Data is returned as 1 value in the following order and format:

Measured SINAD (dB as float).

If there is no valid measurement data, the instrument will return "--"

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch NBFM SINAD numerical data:

`:FETCh:SNDRatio?`

Front Panel Access: **NA**

16-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to “Interpreting Returned Data” on page 16-14 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

```
:FORMat INTeger,32
```

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL|SPECtrum|ASPEctrum|AWAVeform" command on page 16-38.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum datapoints consists of 4 bytes.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

Converting INTeger,32 Example:

The instrument returns the following Spectrum data point in INT,32 format:

b9 c0 fd ff

1. Convert from little endian to big endian:

   ff fd c0 b9

2. Since the MSb in both components is 1, they are negative numbers.
3. The binary representation is:

   11111111111111011100000010111001

4. Convert from two's complement (not the bits and add 1):

   100011111101000111

5. Convert the binary values to decimal:

   147271

6. Take out the 1e3 scale factor:

   147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:
   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

16-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

16-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to NBFM Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
THD (% as float)
SINAD (dB as float)
ExtSINAD (dB as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure NBFM Coverage numerical data:

```
:MEASure:COVerage?
```

Front Panel Access: **NA**

:MEASure:QUIeting?

Description: Sets the active measurement to NBFM Quieting, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:QUIeting` and `:READ:QUIeting?`

Data is returned as 2 comma-separated values in the following order and format:

Measured Voltage (float), Reference Voltage (float).

If there is no valid measurement data, the instrument will return "--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure NBFM Quieting numerical data:

`:MEASure:QUIeting?`

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to NBFM Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

Data is returned as 10 comma-separated values in the following order and format:

Carrier Power (dBm as float or Watts as long long int or Volts as long long int)
Carrier Frequency (Hz as float)
Deviation (Hz as float)
Mod Rate (Hz as float)
SINAD (dB as float)
THD (% as float)
Occ BW (Hz as float)
ExtSINAD (dB as float)
CTCSS (string)
DCS (string)
DTMF (string)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--,--,--,--".

Please note that the received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command `:UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW. If the unit is set to Volts, the received power is returned in fV.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure NBFM Analyzer numerical data:

`:MEASure:SIGAnalyzer?`

Front Panel Access: **NA**

:MEASure:SNDRatio?

Description: Sets the active measurement to NBFM SINAD, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SNDRatio` and `:READ:SNDRatio?`

Data is returned as 1 value in the following order and format:

Measured SINAD (dB as float).

If there is no valid measurement data, the instrument will return "--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure NBFM SINAD numerical data:

`:MEASure:SNDRatio?`

Front Panel Access: **NA**

16-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a setup file:

```
:MMEMory:LOAD:STATe 1,"xxx.stp"
```

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use `:INSTrument:SELect` or `:INSTrument:NSELect` to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should contain a file extension. Note that the trace specified by `<filename>` should be available at the current save location. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

“.spa” for SPA measurement
“.mna” for VNA and VVM measurements
“.hipm” for HiPM measurements
“.pm” for PM measurements
“.cwsg” for CWSG measurements
“.afp” for AM/FM/PM measurements
“.ia” for Interference Analysis measurements
“.cs” for Channel Scanner measurements
“.wmxd” for WiMAX
“.wmxe” for Mobile WiMAX
“.lte” for LTE measurements
“.p25” for P25 measurements
“.p252” for P25p2 measurements
“.nxdn” for NXDN measurements
“.dpmr” for dPMR measurements
“.dmr2” for DMR 2 measurements
“.ptc” for PTC measurements
“.tetra” for TETRA measurements
“.nbfm” for NBFM measurements

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

```
:MMEMory:LOAD:TRACe 1,"xxx.nbfm"
```

Front Panel Access: **Shift 7** (File), Recall Measurement

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a setup file:

```
:MMEMory:STORe:STATe 0,"xxx"
```

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a measurement file:

```
:MMEMory:STORe:TRACe 0,"xxx"
```

Front Panel Access: **Shift 7** (File), Save Measurement

16-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new NBFM Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT`, `:INITiate`, and `:FETCh:COVerage?` NBFM Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
THD (% as float)
SINAD (dB as float)
ExtSINAD (dB as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read NBFM Coverage numerical data:

`:READ:COVerage?`

Front Panel Access: **NA**

:READ:QUIeting?

Description: Triggers a new NBFM Quieting measurement and returns the numerical results. It is a combination of the commands `:ABORT`, `:INITiate`, and `:FETCh:QUIeting?` NBFM Quieting must be the active measurement (specified by `:CONFigure:QUIeting`). The current measurement can be queried using `:CONFigure?`

Data is returned as 2 comma-separated values in the following order and format:

Measured Voltage (float), Reference Voltage (float).

If there is no valid measurement data, the instrument will return "--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read NBFM Quieting numerical data:

`:READ:QUIeting?`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new NBFM Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT; :INITiate; :FETCh:SIGAnalyzer?`

NBFM Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?`

Data is returned as 10 comma-separated values in the following order and format:

Carrier Power (dBm as float or Watts as long long int or Volts as long long int)
Carrier Frequency (Hz as float)
Deviation (Hz as float)
Mod Rate (Hz as float)
SINAD (dB as float)
THD (% as float)
Occ BW (Hz as float)
ExtSINAD (dB as float)
CTCSS (string)
DCS (string)
DTMF (string)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--,--,--,--".

Please note that the received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command `:UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW. If the unit is set to volts, the received power is returned in fV.

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read NBFM Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

:READ:SNDRatio?

Description: Triggers a new NBFM SINAD measurement and returns the numerical results. It is a combination of the commands `:ABORT`, `:INITiate`, and `:FETCh:SNDRatio?` NBFM SINAD must be the active measurement (specified by `:CONFigure:SNDRatio`). The current measurement can be queried using `:CONFigure?`

Data is returned as 1 value in the following order and format:

Measured SINAD (dB as float).

If there is no valid measurement data, the instrument will return "--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read NBFM SINAD numerical data:

`:READ:SNDRatio?`

Front Panel Access: **NA**

16-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the NBFM signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

```
:SOURce:CORRection:OFFSet -10
```

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

```
:SOURce:DM:PATTern 2
```

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format:

0: cw
1: nbfm_ctcss
2: nbfm_dcs
3: nbfm_dtmf
4: nbfm_1khz_ctcss
5: nbfm_1khz_dcs
6: am_1khz_audio
7: fm_1khz_audio

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

`:SOURce:DM:PATTern:LIST?`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

`:SOURce:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the NBFM signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or 223606797749978 fV to 70710678 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

`:SOURce:POWer -10`

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

`:SOURce:STATe ON`

Front Panel Access: **Turn Sig-Gen ON/OFF**

16-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the `MMEMory` subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "`NAME=VALUE[UNITS]`". Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 16-1.

Cmd Parameters: NA

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To get the trace preamble:

`:TRACe:PREamble?`

Front Panel Access: NA

Table 16-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.

Table 16-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style).
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.

Table 16-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.

Table 16-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).

Table 16-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 16-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).

Table 16-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Not used.
SYSTEM_ID	Not used.
COLOR_CODE	Not used.

:TRACe[:DATA]? ALL|SPECtrum|ASPEctrum|AWAVeform

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by `:FORMat:DATA`. Trace setup information can be acquired using `:TRACe[:DATA]:PREamble?` Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
<SPECTRUM>	</SPECTRUM>
<AUDIO_SPECTRUM>	</AUDIO_SPECTRUM>
<AUDIO_WAVEFORM>	</AUDIO_WAVEFORM>

The tags listed above will always show up in the response and will always be in the order described.

Spectrum, audio spectrum, and audio waveform data will only have one element per point. There will also only be 551 points per trace.

Please note that this command only works in the NBFM Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: `ALL|SPECtrum|ASPEctrum|AWAVeform`

Range: ALL|SPECtrum|ASPEctrum|AWAVeform

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

```
:TRACe? SPECtrum
```

Front Panel Access: **NA**

16-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description: Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the NBFM Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm.If the unit is set to Watts, the NBFM Signal Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the NBFM Signal Analyzer received power and squelch setting will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: WATT

Default Unit: **NA**

Example: To set the receiver units to watts:

`:UNIT:POWer:RX WATT`

Front Panel Access: **Amplitude**, Units, Rx Units

:UNIT:POWer:TX DBM|WATT|VOLTs
:UNIT:POWer:TX?

Description: Sets the generator unit to dBm or volts. If the unit is set to dBm, the Tx Output Lvl setting will be set and queried in dBm. If the unit is set to Watts, the Tx Output Lvl setting will be set and queried in fW. If the unit is set to Volts, the Tx Output Lvl will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: VOLTs

Default Unit: **NA**

Example: To set the generator units to volts:

`:UNIT:POWer:TX VOLT`

Front Panel Access: **Amplitude**, Units, Tx Units

16-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

`[:SENSe]:APPLication:TST?`

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

`:SENSe:APPLication:TST?`

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. [:SENSe]:APPLication:TST? must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 show the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 14 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

```
:APPLication:TST?;:APPLication:TST:RESult?
```

Front Panel Access: **Shift 8 (System)**, Application Self Test

`[:SENSe]:AVERage:COUNt <integer>`
`[:SENSe]:AVERage:COUNt?`

Description: Sets the number of times the deviation value in the NBFM Analyzer Summary window is averaged.

Cmd Parameters: <integer>

Query Parameters: **NA**

Range: 1 to 25

Default Value: 1

Default Unit: **NA**

Example: To set averaging to 15:

`:AVERage:COUNt 15`

Front Panel Access: **Setup**, Averaging

`[:SENSe]:BANDwidth[:RESolution] 5|6.25|10|12.5|30|50`
`[:SENSe]:BANDwidth[:RESolution]?`

`[:SENSe]:BWIDth[:RESolution] 5|6.25|10|12.5|30|50`
`[:SENSe]:BWIDth[:RESolution]?`

Description: Sets the IF bandwidth.

Note: IF bandwidth value is set and returned in kHz.

Cmd Parameters: 5|6.25|10|12.5|30|50

Query Parameters: **NA**

Range: 5|6.25|10|12.5|30|50

Default Value: 10

Default Unit: kHz

Example: To change the IF Bandwidth to 50 kHz:

`:BANDwidth 50`

`:BWIDth 50`

Front Panel Access: **Setup**, Filters, IFBW

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description: Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm.

If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted.

The Received Pwr value in the Summary Table is also affected by changing this value.

The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the external attenuation to 30 dB:

`:CORRection:OFFSet 30`

Front Panel Access: **Amplitude**, Rx Power Offset

`[:SENSe]:DM:SQUelch <value>`
`[:SENSe]:DM:SQUelch?`

Description: Sets the squelch power level. The squelch is applied to the NBFM Analyzer Summary Window, the NBFM Analyzer Audio Spectrum, and the NBFM Audio Waveform on the front panel. If the Carrier power is lower than the squelch level, the Audio Spectrum trace will drop to the bottom of the graph, the Audio Waveform trace will stay in the middle of the graph, and the all of the summary numerical values except for Carrier Power will be dashed out. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to Watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW
or 223.6 mV to 223.61 nV

Default Value: -100 dBm or 100 fW or 2.24 µV

Default Unit: dBm or fW or fV

Example: To set the squelch to -10 dBm:

`:DM:SQUelch -10`

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:DEV:MODE PEAK|RMS|AVERage
[:SENSe]:DEV:MODE?

Description: Sets the deviation mode that is displayed in the NBFM Analyzer summary table, 3rd row down. The query will return `PEAK` for peak, `RMS` for RMS, and `AVER` for average.

Cmd Parameters: `PEAK|RMS|AVERage`

Query Parameters: **NA**

Range: PEAK|RMS|AVER

Default Value: PEAK

Default Unit: **NA**

Example: To set the deviation mode to average:

`:DM:PATTern AVER`

Front Panel Access: **Setup**, Deviation Mode

[:SENSe]:DM:PATTern CTCSs|DCS|DTMF
[:SENSe]:DM:PATTern?

Description: Sets the tone type. Setting the tone type will change the 8th numeric value in the summary window to readout the chosen tone type. The query will return `CTCSS` for CTCSS, `DCS` for DCS, and `DTMF` for DTMF. Please note that setting the tone type will restart the sweep.

Cmd Parameters: `CTCSs|DCS|DTMF`

Query Parameters: **NA**

Range: CTCSs|DCS|DTMF

Default Value: CTCSs

Default Unit: **NA**

Example: To set the modulation type to DTMF

`:DM:PATTern DTMF`

Front Panel Access: **Setup**, Tone Type

[:SENSe]:FILTer:DEMPhasis[:STATe] OFF|ON|0|1
[:SENSe]:FILTer:DEMPhasis[:STATe]?

Description: Sets the de-emphasis filter on or off.

Cmd Parameters: OFF|ON|0|1

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the de-emphasis filter on:

`:FILTer:DEMPhasis ON`

Front Panel Access: **Setup**, Filter, De-emphasis Filter

[:SENSe]:FILTer:FREQuency 0.3|3|15|NONE
[:SENSe]:FILTer:FREQuency?

Description: Sets the low pass filter frequency.

Note: Low pass filter frequency value is set and returned in kHz (except for NONE).

Cmd Parameters: `0.3|3|15|NONE`

Query Parameters: **NA**

Range: 0.3|3|15|NONE

Default Value: 3

Default Unit: kHz

Example: To set the low pass filter frequency to 15 kHz:

`:FILTer:FREQuency 15`

Front Panel Access: **Setup**, Filter, Low Pass Filter

[:SENSe]:FILTer:HPASs:FREQuency 0.3|3|NONE
[:SENSe]:FILTer:HPASs:FREQuency?

Description: Sets the high pass filter frequency.

Note: High pass filter frequency value is set and returned in kHz (except for NONE).

Cmd Parameters: `0.3|3|NONE`

Query Parameters: **NA**

Range: 0.3|3|NONE

Default Value: None

Default Unit: kHz

Example: To set the high pass filter frequency to 300 Hz:

`:FILTer:HPASs:FREQuency 0.3`

Front Panel Access: **Setup**, Filter, High Pass Filter

[:SENSe]:FM:SENSitivity:REFerence:SET

Description: Sets the reference voltage for NBFM Quieting. Setting the reference will automatically adjust the voltage scale such that the voltage displayed in middle of the meter is 10 % (-20 dB) of the reference voltage.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To set NBFM Quieting reference:

`:FM:SENSitivity:REFerence:SET`

Front Panel Access: **Measurement**, NBFM Quieting, Set Reference

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

`:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:CENTer:AUTO OFF|ON|0|1
[:SENSe]:FREQuency:CENTer:AUTO?

Description: Sets auto scan on or off. When auto scan is turned on, the receiver frequency will automatically be set to the frequency with the highest power reading. Use `[:SENSe]:FREQuency:CENTer?` to retrieve the current receiver frequency.

Changing the Rx frequency using the front panel or `[:SENSe]:FREQuency:CENTer <value>` will turn Auto Scan off.

Cmd Parameters: OFF|ON|0|1

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn auto testing on:

`:FREQuency:CENTer:AUTO ON`

Front Panel Access: **Setup**, Auto Scan

[:SENSe]:FREQuency:COUPling OFF|ON|0|1
[:SENSe]:FREQuency:COUPling?

Description: Turns on frequency coupling. When frequency coupling is on, the Tx frequency cannot be set directly. The Rx Frequency and coupling offset must be used to set the desired Tx frequency. The Tx frequency will automatically trail the Rx frequency by the frequency coupling offset every time the Rx frequency is set. Please note that turning on frequency coupling will automatically move the Tx frequency to the Rx frequency plus any frequency coupling offset. If the Rx frequency and frequency coupling offset is at a setting where the Tx frequency will be beyond the min/max limits, the instrument will not allow coupling to be turned on. The query command returns the state of the frequency coupling setting. A return value of 1 is ON, and a return value of 0 is OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn Rx/Tx frequency coupling on:

`:FREQuency:COUPling ON`

Front Panel Access: **Frequency**, Rx/Tx Coupling

[:SENSe]:FREQuency:COUPling:OFFSet <value>
[:SENSe]:FREQuency:COUPling:OFFSet?

Description: Sets the frequency coupling offset. If frequency coupling is on, the Tx frequency will automatically trail the Rx frequency by this amount. Please note that the instrument will prevent any coupling offset setting that will make the Tx frequency go beyond the min/max values. The query returns the current coupling offset in Hz.

Cmd Parameters: `<Value>`

Query Parameters: **NA**

Range: -1000000000 Hz to 1000000000 Hz

Default Value: 0 Hz

Default Unit: Hz

Example: To set coupling offset to 200 MHz:

`:FREQuency:COUPling:OFFSet 200000000`

Front Panel Access: **Frequency**, Coupling Offset

[:SENSe]:FREQuency:SPAN 12.5|25|50
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in NBFM Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `12.5|25|50`

Query Parameters: NA

Range: 12.5|25|50

Default Value: 25

Default Unit: kHz

Example: To set the span to 50 kHz:

`:FREQuency:SPAN 50`

Front Panel Access: **Frequency**, Span

[:SENSe]:FREQuency:SPAN:AUDio 0.3|2|5|10|20|30
[:SENSe]:FREQuency:SPAN:AUDio?

Description: Sets the audio span. The setting only applies to the NBFM Analyzer Audio Spectrum graph.

Note: Audio span frequency value is set and returned in kHz.

Cmd Parameters: `0.3|2|5|10|20|30`

Query Parameters: **NA**

Range: 0.3|2|5|10|20|30

Default Value: 30

Default Unit: kHz

Example: To set the audio spectrum span to 5 kHz:

`:FREQuency:SPAN:AUDio 5`

Front Panel Access: **Measurement**, NBFM Analyzer, Audio Span

[:SENSe]:OBWidth:METHod PERCent|XDB
[:SENSe]:OBWidth:METHod?

Description: Sets the method for calculating occupied bandwidth. XDB calculates the occupied bandwidth based on points that are 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.

Cmd Parameters: `PERCent|XDB`

Query Parameters: **NA**

Range: PERCent|XDB

Default Value: PERCent

Default Unit: **NA**

Example: To set occupied bandwidth using percentage of power:

`:OBWidth:METHod PERCent`

Front Panel Access: **Measurement**, NBFM Analyzer, Occ BW Setup, Occ BW Method

[:SENSe]:OBWidth:PERCent <percentage>
[:SENSe]:OBWidth:PERCent?

Description: This command sets the percentage of carrier power that is used to measure the occupied bandwidth. This value is used in the measurement if `:SENSe:OBWidth:METHod` is set to `PERCent`.

Cmd Parameters: <percentage>

Query Parameters: **NA**

Range: 0% to 100%

Default Value: 99%

Default Unit: %

Example: To change the occ bw percent to 70%:

`:OBWidth:PERCent 70.00`

Front Panel Access: **Measurement**, NBFM Analyzer, Occ BW Setup, % Int Pwr

[:SENSe]:OBWidth:XDB <rel ampl>
[:SENSe]:OBWidth: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`.

Cmd Parameters: <rel ampl>

Query Parameters: **NA**

Range: 0 dBc to 100 dBc

Default Value: 3 dBc

Default Unit: dBc

Example: To change the occ bw XDB to 10:

`:OBWidth:XDB 10`

Front Panel Access: **Measurement**, NBFM Analyzer, Occ BW Setup, > dBc

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In NBFM Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To adjust range:

`:POWer:RANGe`

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In NBFM Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To turn auto ranging off:

`:POWer:RANGe:AUTO OFF`

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe:]SWEep:TIME:AUDio <time>
[:SENSe:]SWEep:TIME:AUDio?

Description: Sets the audio sweep time. The setting only applies to the NBFM Analyzer Audio Waveform graph.

Cmd Parameters: `<time>`

Query Parameters: **NA**

Range: 50 us to 150 ms

Default Value: 100 ms

Default Unit: us

Example: To set the audio sweep time to 75 ms:

```
:SWEep:TIME:AUDio 75000
```

Front Panel Access: **Measurement**, NBFM Analyzer, Audio Sweep Time

Chapter 17 — TETRA Commands

17-1 :ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Description: Restarts the current sweep and/or measurement. If `:INITiate:CONTinuous` is OFF (i.e., the instrument is in hold mode), send the command `:INITiate[:IMMediate]` to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e., the instrument is in run mode), a new sweep will start immediately.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To abort a measurement:

`:ABORt`

Front Panel Access: **NA**

17-2 :CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

Note	Sending a non-query :CONFigure command will change the Sweep setting from Run to Hold.

`:CONFigure?`

Description: `:CONFigure?` query returns the name of the measurement previously set up using a `CONFigure` command or a `MEASure?` query. The list below shows the possible return values and the actual names of each configuration.

Returns Value	Actual Name
`SIGA`	TETRA Analyzer
`COV`	TETRA Coverage

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query the current measurement type:

`:CONFigure?`

Front Panel Access: **Measurement**

:CONFigure:COVerage

Description: This command configures the TETRA Coverage measurement. Certain settings from the previous measurement (Mapping Type) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to TETRA Coverage:

```
:CONFigure:COVerage
```

Front Panel Access: **Measurement**, TETRA Coverage

:CONFigure:SIGAnalyzer

Description: This command configures the TETRA Analyzer measurement. Certain settings from the previous measurement (Ref Lvl, Scale, Graph Types, Maximize) will be backed up when exiting this measurement and restored when entering this measurement. All other settings carry over from one measurement to the other.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To switch the measurement to TETRA Analyzer:

```
:CONFigure:SIGAnalyzer
```

Front Panel Access: **Measurement**, TETRA Analyzer

17-3 :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[:WINDow]:TRACe:SELect?

Description: This command returns the current active trace number in the format TRAC#.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To query for the active trace number:

```
:DISPlay:TRACe:SELect?
```

Front Panel Access: **Measurement**, TETRA Analyzer, Active Graph

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision?

Description: Sets the scale per division for the y-axis. In the TETRA Analyzer measurement, this value corresponds to the scale on the spectrum graph type.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 1 to 15

Default Value: 10

Default Unit: **NA**

Example: To set the scale to 8:

```
:DISPlay:TRACe:Y:PDIVision 8
```

Front Panel Access: **Amplitude**, Scale

:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel <value>
:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel?

Description: Sets the reference level scale value for the y-axis. In the TETRA Analyzer measurement, this value corresponds to the reference level on the spectrum graph type.

Note	Turning auto range on will automatically adjust the reference level. If auto range is on and this command is sent, the reference level will be set to the value until the next sweep. If auto range is off, the unit will keep the value until either auto range is turned back on, the reference level is changed, or a preset is activated.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: -300 dBm to 20 dBm

Default Unit: dBm

Example: To set the reference level to -40:

`:DISPlay:TRACe:Y:RLEVel -40`

Front Panel Access: **Amplitude**, Ref Lvl

:DISPlay[:WINDow]:TRACe:FORMat:COVerage <mapping type>
:DISPlay[:WINDow]:TRACe:FORMat:COVerage?

Description: Defines the mapping type. <mapping type> is the type of data that is being mapped. Note that RSSI, BER, and EVM data will be stored, but only the selected mapping type will be used in the comparisons to determine the color of the points on the map. Mapping type must be one of the following values:

`RSSI|BER|EVM`

The query version of this command returns `"RSSI"` if the mapping type is set to RSSI, `"BER"` if set to BER, and `"EVM"` if set to EVM.

Please note that this command only works when the current measurement is set to TETRA Coverage. Refer to the Related Command below.

Cmd Parameters: `<mapping type>`

Query Parameters: **NA**

Range: RSSI|BER|EVM

Default Value: RSSI

Default Unit: **NA**

Example: To set mapping type to EVM:

`:DISPlay:TRACe:FORMat:COVerage EVM`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **Measurement**, TETRA Coverage, Mapping Type

:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer <graph type>
:DISPlay[:WINDow]:TRACe<Tr>:FORMat:SIGAnalyzer?

Description: Defines the graph type for the given trace `<Tr>`. `<Tr>` is the trace number in the range 1 to 4. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1. `<Graph Type>` is the graph type to which the specified trace is set, and it must be one of the following values:

`CONStellation|SPECtrum|SUMMary|EYEDiagram|TETRasummary`

The query version of this command returns "CONS" if the specified trace graph type is set to Constellation, "SPEC" if set to Spectrum, "SUMM" if set to Summary, "EYED" if set to Eye Diagram, and "TETR" if set to TETRA Summary.

Please note that this command only works when the current measurement is set to TETRA Analyzer.

Cmd Parameters: `<graph type>`

Query Parameters: **NA**

Range: CONStellation|SPECtrum|SUMMary|EYEDiagram|TETRasummary

Default Value: Trace 1: Constellation
Trace 2: Spectrum
Trace 3: Tetra Summary
Trace 4: Summary

Default Unit: **NA**

Example: To set Trace 2 graph type to Eye Diagram:

`:DISPlay:TRACe2:FORMat:SIGAnalyzer EYEDiagram`

Related Command: :CONFigure:SIGAnalyzer

Front Panel Access: **Measurement**, TETRA Analyzer, Graph Type

:DISPlay[:WINDow]:TRACe<Tr>:SELect

Description: Selects the given trace, `<Tr>`, as the active trace. `<Tr>` is the trace number in the range 1 to 4 for TETRA Analyzer. If no trace number is specified, then the `<Tr>` parameter defaults to trace number 1.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: TRAC1

Default Unit: **NA**

Example: To set trace 2 as the active trace:

`:DISPlay:TRACe2:SELect`

Front Panel Access: **Measurement**, TETRA Analyzer, Active Graph

17-4 :FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To prepare for a new measurement, use the `CONFigure` command. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands.

:FETCh:COVerage?

Description: Returns the most recent TETRA Coverage numerical measurement results. Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
EVM (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch TETRA Coverage numerical data:

`:FETCh:COVerage?`

Related Command: :CONFigure:COVerage

Front Panel Access: **NA**

:FETCh:SIGAnalyzer?

Description: Returns the most recent TETRA Analyzer numerical measurement results. Data is returned as 14 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
EVM (% as float)
BER (% as float)
IQ Imbal (dB as float)
BS ECC (hex)
Symbol Rate Error (Hz as float)
Phase Error (degree as float)
Mag Error (dB as float)
Mobile CC (int)
Mobile NC (int)
Base CC (int)
LAC (int)
MS Max Tx Pwr (dBm as int)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To fetch TETRA Analyzer numerical data:

`:FETCh:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

17-5 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

`:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32`
`:FORMat[:READings][:DATA]?`

Description: This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units.

INTeger,32 values are always multiplied by a factor of 1e3 for precision. For example, if the measured result were -120.345 dBm, then that value would be sent as –120345.

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 instrument units.

Each transfer begins with an ASCII header such as #800004510 for INTeger,32 and REAL,32. The first digit represents the number of following digits in the header (in this example, 8). The remainder of the header indicates the number of bytes that follow the header (in this example, 4510 for INT,32 and REAL,32). The tags and datapoints follow the header.

Refer to "Interpreting Returned Data" on page 17-10 for additional information and conversion examples.

Cmd Parameters: `ASCii|INTeger,32|REAL,32`

Query Parameters: **NA**

Range: ASCii|INTeger,32|REAL,32

Default Value: ASCii

Default Unit: **NA**

Example: To set the numeric data format to integer:

`:FORMat INTeger,32`

Front Panel Access: **NA**

Interpreting Returned Data

The following section provides two conversion examples on interpreting returned data. Examples are provided for both integer and real number formats.

Converting INTeger,32 and REAL,32 Values

The number of bytes the instrument returns is dependent on the parameter specified with the ":TRACe[:DATA]? ALL | CONStellation | SPECtrum | EYEDiagram" command on page 17-30.

- The first 10 bytes make up the "header" information.
- The data portion contain tags to demarcate different data sets. The first valid datapoint starts *x* bytes after the header where *x* is the number of characters that make up the tag. For example, *<CONSTELLATION>* is *15* bytes. Skip as many bytes as there are characters to get to the start of the data.
- Spectrum and Histogram datapoints consists of 4 bytes.
- Eye Diagram datapoints [12 X-axis points and (12 x ((551 / Number Of Symbols) - 1)) Y-axis points] are 4 bytes each.
- Each Constellation datapoint consists of 8 bytes.
  - The first 4 bytes are the I component
  - The next 4 bytes are the Q component.
- The returned value is in little endian format (the little end comes first).
- Negative numbers are represented in two's complement format.
- The data is scaled by a factor of 1e3.

Converting INTeger,32 Example:

The instrument returns the following Spectrum data point in INT,32 format:

b9 c0 fd ff

1. Convert from little endian to big endian:

   ff fd c0 b9

2. Since the MSb in both components is 1, they are negative numbers.
3. The binary representation is:

   11111111111111011100000010111001

4. Convert from two's complement (not the bits and add 1):

   100011111101000111

5. Convert the binary values to decimal:

   147271

6. Take out the 1e3 scale factor:

   147271/1000 * -1 = -147.271

Converting REAL,32 Example:

The instrument returns the following values in REAL,32 format:

25 06 14 c3

1. Convert from little endian to big endian:

   c3 14 06 25

2. The binary representation of the real portion, C3 14 06 25 is:

   11000011000101000000011000100101

3. Binary is in IEEE format:
   - 1st bit is sign bit
   - next 8 bits are exponent
   - next 23 bits are normalized value

4. Convert binary to decimal:

   1, the MSb is the sign bit

   10000110, exponent. The actual exponent value is this value minus 127. So, it is 134 – 127 = 7.

   00101000000011000100101 (as normalized value) and adding 1 and multiplying by 2^exponent results in 1+(0/2+0/4+1/8+0/16+1/32+0/64+...) * 2^7 = -148.024 (taking into account the sign bit) (approx.)

17-6 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Description: Initiates a sweep/measurement. Use this command in combination with `:STATus:OPERation?` 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 is 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.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a sweep/measurement:

`:INITiate`

Front Panel Access: **Shift 3 (Sweep)**, Trigger Sweep

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Description: Sets the sweep to run or hold. If the instrument is currently sweeping, then setting a value of OFF or 0 stops the trace from updating. The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`. The query version of this command returns a 1 if the instrument is set to Run, and it returns a 0 if set to Hold.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To put the unit into hold:

`:INITiate:CONTinuous OFF`

Front Panel Access: **Shift 3 (Sweep)**, Sweep

17-7 :MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They 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. They then initiate the measurement. When the measurement is complete, they return the result.

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:COVerage?

Description: Sets the active measurement to TETRA Coverage, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:COVerage` and `:READ:COVerage?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
EVM (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure TETRA Coverage numerical data:

`:MEASure:COVerage?`

Front Panel Access: **NA**

:MEASure:SIGAnalyzer?

Description: Sets the active measurement to TETRA Analyzer, triggers a new measurement and returns the numerical results. It is a combination of the commands `:CONFigure:SIGAnalyzer` and `:READ:SIGAnalyzer?`

Data is returned as 14 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
EVM (% as float)
BER (% as float)
IQ Imbal (dB as float)
BS ECC (hex)
Symbol Rate Error (Hz as float)
Phase Error (degree as float)
Mag Error (dB as float)
Mobile CC (int)
Mobile NC (int)
Base CC (int)
LAC (int)
MS Max Tx Pwr (dBm as int)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: The `squelch` setting `[:SENSe]:DM:SQUelch` will blank out (--) all summary measurements on the instrument display except for Received Pwr when the received power level is lower than the squelch power setting. The received power level is also affected by the Rx Power Offset setting. The query command will still return values even if the instrument display is blanked out.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To measure TETRA Analyzer numerical data:

`:MEASure:SIGAnalyzer?`

Front Panel Access: **NA**

17-8 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:LOAD:STATe <integer>,<filename>

Description: Recalls a previously stored instrument setup in the current save location.

The setup file to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a setup file:

`:MMEMory:LOAD:STATe 1,"xxx.stp"`

Front Panel Access: **Shift 7** (File), Recall

:MMEMory:LOAD:TRACe <integer>,<filename>

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use `:INSTrument:SELect` or `:INSTrument:NSELect` to set the mode.

Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by `<filename>` should be available at the current save location. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 1.

After recalling the data file, the unit is put into HOLD mode. Setting the unit back to RUN mode will clear the recalled data, but keep the recalled setup.

File name extensions:

“.spa” for SPA measurement
“.mna” for VNA and VVM measurements
“.hipm” for HiPM measurements
“.pm” for PM measurements
“.cwsg” for CWSG measurements
“.afp” for AM/FM/PM measurements
“.ia” for Interference Analysis measurements
“.cs” for Channel Scanner measurements
“.wmxd” for WiMAX
“.wmxe” for Mobile WiMAX
“.lte” for LTE measurements
“.p25” for P25 measurements
“.p252” for P25p2 measurements
“.nxdn” for NXDN measurements
“.dpmr” for dPMR measurements
“.dmr2” for DMR 2 measurements
“.ptc” for PTC measurements
“.tetra” for TETRA measurements
“.nbfm” for NBFM measurements

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To recall a measurement file:

```
:MMEMory:LOAD:TRACe 1,"xxx.tetra"
```

Front Panel Access: **Shift 7** (File), Recall Measurement

Note	IQ Data measurements cannot be recalled on the instrument.

:MMEMory:STORe:STATe <integer>,<filename>

Description: Stores the current setup into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a value of 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a setup file:

`:MMEMory:STORe:STATe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save

:MMEMory:STORe:TRACe <integer>,<filename>

Description: Stores the trace into the file specified by `<filename>`. `<filename>` should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current save location. The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Cmd Parameters: `<integer>,<filename>`

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To save a measurement file:

`:MMEMory:STORe:TRACe 0,"xxx"`

Front Panel Access: **Shift 7** (File), Save Measurement

Note	IQ Data measurements cannot be saved on the instrument.

17-9 :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 prepare for a new measurement, use the `CONFigure` command. To get the current measurement data, use the FETCh command.

:READ:COVerage?

Description: Triggers a new TETRA Coverage measurement and returns the numerical results. It is a combination of the commands `:ABORT; :INITiate; :FETCh:COVerage?` TETRA Coverage must be the active measurement (specified by `:CONFigure:COVerage`). The current measurement can be queried using `:CONFigure?`

Data is returned as 7 comma-separated values in the following order and format:

RSSI (dBm as float)
BER (% as float)
EVM (% as float)
Latitude (radian as float)
Longitude (radian as float)
UTC Date (month/day/year as char)
UTC Time (hour:minute:second as char)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--".

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read TETRA Coverage numerical data:

`:READ:COVerage?`

Related Command: `:CONFigure:COVerage`

Front Panel Access: **NA**

:READ:SIGAnalyzer?

Description: Triggers a new TETRA Analyzer measurement and returns the numerical results. It is a combination of the commands `:ABORT; :INITiate; :FETCh:SIGAnalyzer?`

TETRA Analyzer must be the active measurement (specified by `:CONFigure:SIGAnalyzer`). The current measurement can be queried using `:CONFigure?` Data is returned as 14 comma-separated values in the following order and format:

Received Power (dBm as float or Watts as long long int or Volts as long long int)
Frequency Error (Hz as float)
EVM (% as float)
BER (% as float)
IQ Imbal (dB as float)
BS ECC (hex)
Symbol Rate Error (Hz as float)
Phase Error (degree as float)
Mag Error (db as float)
Mobile CC (int)
Mobile NC (int)
Base CC (int)
LAC (int)
MS Max Tx Pwr (dBm as int)

If there is no valid measurement data, the instrument will return "--,--,--,--,--,--,--,--,--,--,--,--,--,--".

The received power will be returned in the unit that is selected through the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the receiver unit has been set to dBm, the received power is returned in dBm. If the unit is set to Watts, the received power is returned in fW (10^{-15} W). If the unit is set to Volts, the received power is returned in fV (10^{-15} V).

Note: This command is not affected by the squelch level set using the front panel.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To read TETRA Analyzer numerical data:

`:READ:SIGAnalyzer?`

Related Command: `:CONFigure:SIGAnalyzer`

Front Panel Access: **NA**

17-10 :SOURce Subsystem

The commands in this subsystem control the internal signal source.

:SOURce:CORRection:OFFSet[:MAGNitude] <value>
:SOURce:CORRection:OFFSet[:MAGNitude]?

Description: Sets the power level offset for the TETRA signal generator. Please note that changing this value will also cause the display of the Tx output level to adjust to the new offset. For example, if the output level is set to 0 dBm and the level offset is then set to 10 dB external gain, the max limit and value of the output level will be adjusted to 10 dBm. The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the signal generator offset to 10 dB external gain:

`:SOURce:CORRection:OFFSet -10`

Front Panel Access: **Amplitude**, Tx Power Offset

:SOURce:DM:PATTern <value>
:SOURce:DM:PATTern?

Description: Sets the signal generator pattern. The command only accepts the numerical value of the position the pattern is on the list (starting from 0). To retrieve the numerical values attached to each pattern, use `:SOURce:DM:PATTern:LIST?` The query returns a numerical value corresponding to the position of the current Tx pattern in the pattern list.

Cmd Parameters: <value>

Query Parameters: **NA**

Range: 0 to Number of Patterns

Default Value: 0

Default Unit: **NA**

Example: To set the pattern to the 3rd pattern in the signal generator pattern list:

`:SOURce:DM:PATTern 2`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:DM:PATTern:LIST?

Description: Retrieves a list of signal generator pattern names and the index number that is used to set the pattern. The pattern names match the names of the pattern list that pops up when the Tx Pattern button is pushed and the index number is the position of the pattern on that list. The command returns a list with the following format and patterns:

0: tetra_bs_idle_unallocPCH
1: tetra_bs_busy_allocPCH
2: cw
3: am_1khz_audio
4: fm_1khz_audio

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To retrieve the signal generator pattern list:

`:SOURce:DM:PATTern:LIST?`

Front Panel Access: **Setup**, Tx Pattern

:SOURce:FREQuency:CENTer <value>
:SOURce:FREQuency:CENTer?

Description: Sets the signal generator center frequency. Please note that setting the center frequency will restart the sweep. The query returns the current signal generator frequency in Hz.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 500000 Hz to 1600000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the signal generator center frequency to 145 MHz:

`:SOURce:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Tx Freq

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <value>
:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description: Sets the output power level for the TETRA signal generator. Please note that changing the Tx power offset will also cause the display of this to adjust to the new offset. For example, if the output level is set to 0 dBm and the Tx level offset is then set to 10 dB external gain, the max limit and value of the Tx output level will be adjusted to 10 dBm. The query returns the current Tx output level.

The query will be returned in the unit that is selected through the Tx Units button on the front panel or with the command: `UNIT:POWer:TX`. The set command must be sent using the units selected. If the receiver unit has been set to dBm, the generator output level is returned in dBm and must be set in dBm. If the unit is set to Watts, the generator output level is returned in fW (10^{-15} W) and must be set in fW. If the unit is set to Volts, the generator output level is returned in fV (10^{-15} V) and must be set in fV.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 0 dBm to -130 dBm or 1 mW to 1 fW or
70710678 fV to 223606797749978 fV

Default Value: 0 dBm or 1 mW or 223606797749978 fV

Default Unit: dBm or fW or fV

Example: To set the signal generator output level to -10 dBm:

```
:SOURce:POWer -10
```

Front Panel Access: **Amplitude**, Tx Output Lvl

:SOURce:STATe OFF|ON|0|1
:SOURce:STATe?

Description: Turns the signal generator ON or OFF. Please note that the Generator ON/OFF button will toggle depending on the state. When the signal generator is on, the button will show Turn Sig-Gen OFF. When the signal generator is off, the button will show Turn Sig-Gen ON. The query returns the current signal generator state. A return value of 1 means ON and a return value of 0 means OFF.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: OFF

Default Unit: **NA**

Example: To turn the signal generator on:

```
:SOURce:STATe ON
```

Front Panel Access: **Turn Sig-Gen ON/OFF**

17-11 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:PREamble?

Description: Returns trace header information. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory. The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format #AX, where A is the number of digits in X, and X is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter is returned as "NAME=VALUE[UNITS]". Note that the parameters that are returned depend on the firmware version and that this document may not cover all parameter values that are returned by the command. Refer to Table 17-1.

Cmd Parameters: NA

Query Parameters: NA

Range: NA

Default Value: NA

Default Unit: NA

Example: To get the trace preamble:

`:TRACe:PREamble?`

Front Panel Access: NA

Table 17-1. Returned Parameter Values in Trace Preamble (Sheet 1 of 7)

Parameter Name	Description
SN	Instrument serial number.
UNIT_NAME	Instrument name.
TYPE	The data type (Setup or data).
DATE	Trace date and time.
APP_NAME	Application name.
APP_VER	Application firmware (FW) version.
GPS_FIX_AVAIL	Status of GPS lock. Please note that none of the GPS information will show if there is no GPS lock.
GPS_FIX_TIME	Current UTC time shown in hours, minutes, seconds. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_LONGITUDE	Current longitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current longitude will be returned.

Table 17-1. Returned Parameter Values in Trace Preamble (Sheet 2 of 7)

Parameter Name	Description
GPS_FIX_LATITUDE	Current latitude shown in degrees, minutes, seconds. Even if a file has been recalled, the current latitude will be returned.
GPS_FIX_VALUE_TIME	Current UTC time shown as seconds elapsed since 0:00 January 1st, 1970. Even if a file has been recalled, the current UTC time will be returned.
GPS_FIX_VALUE_LON	Current longitude shown in radians (as a long data type). Even if a file has been recalled, the current longitude will be returned.
GPS_FIX_VALUE_LAT	Current latitude shown in radians (as a long data type). Even if a file has been recalled, the current latitude will be returned.
RECEIVER_FREQ	Receiver (Rx) frequency.
EXT_ATT	Receiver (Rx) power offset.
REF_LVL	Reference level. For Analyzer, this setting corresponds to the Spectrum graph.
REF_LVL_TX	Backup reference level for Analyzer.
REF_LVL_TOC	Backup reference level for Coverage (Not in use with new mapping style).
SCALE	Scale. For Analyzer, this setting corresponds to the Spectrum graph.
SCALE_TX	Backup scale for Analyzer.
SCALE_TOC	Backup scale for Coverage (Not in use with new mapping style).
TOC_BER_REF	BER reference percentage (Not in use with new mapping style).
TOC_MOD_FID_REF	Mod fid reference percentage (Not in use with new mapping style).
GRAPH_TYPE	Graph type of the selected graph (Active graph).
GRAPH_TYPE_TX	Backup graph type for Analyzer.
GRAPH_TYPE_TOC	Backup graph type for Coverage (Not in use with new mapping style).
TRACE_GRAPH_TYPES	Graph types for all 4 traces. This uses a bit mask shift, where the bit shift mask is defined as: GRAPH_TYPE_BIT_SHIFT 16 GRAPH_TYPE_BIT_MASK 0xFFFF
TRACE_GRAPH_TYPES_TX	Backup trace graph type for Analyzer.
TRACE_GRAPH_TYPES_TOC	Backup trace graph type for Coverage (Not in use with new mapping style).
ACTIVE_GRAPH	Selected graph.
ACTIVE_GRAPH_TX	Backup active graph for Analyzer.

Table 17-1. Returned Parameter Values in Trace Preamble (Sheet 3 of 7)

Parameter Name	Description
ACTIVE_GRAPH_TOC	Backup active graph for Coverage (Not in use with new mapping style).
MAXIMIZE_GRAPH	Determines whether active graph is maximized or minimized.
MAXIMIZE_GRAPH_TX	Backup maximize graph for Analyzer.
MAXIMIZE_GRAPH_TOC	Backup maximize graph for Coverage (Not in use with new mapping style).
TOTAL_GRAPHS	Total graphs shown on the screen when minimized. Analyzer is hard coded to 4 graphs.
MEAS_TYPE	Measurement type. 0 = Analyzer 1 = Not used 2 = Control (Only used in P25, P25p2, NXDN, DMR2) 3= Bit Capture (Only used in P25, P25p2, NXDN, DMR2) 4 = Coverage 5 = NBFM Quieting (Only used in NBFM) 6 = NBFM SINAD (Only used in NBFM)
EXTERNAL_REFERENCE	Not used.
REFERENCE_FREQUENCY	The frequency to which the external reference is locked.
MEAS_DISPLAY	State of the numerical display window in the Coverage measurement.
MEAS_DISPLAY_TX	Backup measurement display for Analyzer.
MEAS_DISPLAY_TOC	Backup measurement display for Coverage (Not in use with new mapping style).
PATTERN	Receiver (Rx) pattern.
DYNAMIC_ATTENUATION	Auto receiver (Rx) range. Determines if reference level is automatically adjusted according to the receiver input signal.
LOG_TYPE	Auto logging type (Not in use with new mapping style).
KML_FLAG_LABEL	Not used.
KML_FLAG_TIME	Not used.
SYMBOL	Number of symbols shown in the horizontal axis of the Analyzer Eye Diagram.
RECEIVER_UNITS	Receiver unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_UNITS	Generator unit type. 0 is dBm, 1 is Watts, 2 is Volts.
GENERATOR_OUTPUT	State of the signal generator. 0 is ON and 1 is OFF.
GENERATOR_FREQ	Frequency of the signal generator.

Table 17-1. Returned Parameter Values in Trace Preamble (Sheet 4 of 7)

Parameter Name	Description
GENERATOR_PATTERN	Pattern that the signal generator is outputting. The value corresponds to the index (starting from 0) of the list returned from issuing a `:SOURce:DM:PATTern:LIST?` command.
GENERATOR_OUTPUT_LVL	Output power level of the signal generator.
GENERATOR_OUTPUT_LVL_BK	Backup generator power level. Used to store original generator power level when Tx Power Offset is applied.
HEX_TRIGGER	State of hex triggering for Control Channel. 0 is ON and 1 is OFF.
HEX_TRIGGER_VALUE	When value is detected in the first octet of a Control Channel packet, the unit will be put into Hold mode.
COUPLING	State of frequency coupling. 0 is ON and 1 is OFF.
FREQ_COUPLING_OFFSET	Amount that the Receiver (Rx) and Generator (Tx) frequency is offset by when frequency coupling is ON.
GENERATOR_LVL_OFFSET	Generator (Tx) power offset.
SQUELCH	Squelch level for the Analyzer summary window.
SQUELCH_BK	Backup value for squelch level when Receiver Power Offset is applied.
SPAN	Receiver (Rx) span.
AVERAGING	Number of times numerics in the summary window are averaged.
AM_PERCENTAGE	Percentage for the am_1khz_audio generator pattern.
FM_DEVIATION	Deviation for the fm_1khz_audio generator pattern.
NAC	Not used.
NAC_BK	Not used.
RSSI_MAPPING_EXCELLENT	Threshold at which the RSSI mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
RSSI_MAPPING_VERY_GOOD	Threshold at which the RSSI mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
RSSI_MAPPING_GOOD	Threshold at which the RSSI mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
RSSI_MAPPING_FAIR	Threshold at which the RSSI mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
RSSI_MAPPING_POOR	Threshold at which the RSSI mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).

Table 17-1. Returned Parameter Values in Trace Preamble (Sheet 5 of 7)

Parameter Name	Description
BER_MAPPING_EXCELLENT	Threshold at which the BER mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
BER_MAPPING_VERY_GOOD	Threshold at which the BER mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
BER_MAPPING_GOOD	Threshold at which the BER mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
BER_MAPPING_FAIR	Threshold at which the BER mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
BER_MAPPING_POOR	Threshold at which the BER mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC, TETRA).
MOD_FID_MAPPING_EXCELLENT	Threshold at which the Mod Fid mapping value is deemed excellent (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_VERY_GOOD	Threshold at which the Mod Fid mapping value is deemed very good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_GOOD	Threshold at which the Mod Fid mapping value is deemed good (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_FAIR	Threshold at which the Mod Fid mapping value is deemed fair (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
MOD_FID_MAPPING_POOR	Threshold at which the Mod Fid mapping value is deemed poor (Only used in P25, P25p2, NXDN, dPMR, DMR2, PTC).
EVM_MAPPING_EXCELLENT	Threshold at which the EVM mapping value is deemed excellent (Only used in TETRA).
EVM_MAPPING_VERY_GOOD	Threshold at which the EVM mapping value is deemed very good (Only used in TETRA).
EVM_MAPPING_GOOD	Threshold at which the EVM mapping value is deemed good (Only used in TETRA).
EVM_MAPPING_FAIR	Threshold at which the EVM mapping value is deemed fair (Only used in TETRA).
EVM_MAPPING_POOR	Threshold at which the EVM mapping value is deemed poor (Only used in TETRA).
MAPPING_TYPE	Mapping value that is being compared with threshold values.

Table 17-1. Returned Parameter Values in Trace Preamble (Sheet 6 of 7)

Parameter Name	Description
NUMERIC_DISPLAY	Determines what values are displayed in the Analyzer summary window.
DEMOD_TYPE	Modulation type (used with P25, P25p2, DMR 2, and PTC).
MOD_BANDWIDTH	Modulation bandwidth (used with NXDN and dPMR only).
RX_SLOT	Receiver (Rx) time slot selection (Only used for DMR 2).
TX_SLOT	Generator (Tx) time slot selection (Only used for DMR 2).
HIGH_PASS_FILTER	High pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is None.
LOW_PASS_FILTER	Low pass filter selection (Only used for NBFM). 0 is 300 Hz, 1 is 3 kHz, 2 is 15 kHz, 3 is None.
AUDIO_SPECTRUM_SPAN	Span for the Audio Spectrum graph in NBFM Analyzer (Only used in NBFM).
AUDIO_WAVE_SWEEP_TIME	Sweep time for the Audio Waveform graph in NBFM Analyzer (Only used in NBFM).
DEEMPHASIS	State of the De-emphasis filter (Only used in NBFM). 0 is ON and 1 is OFF.
SINAD_MAPPING_EXCELLENT	Threshold at which the SINAD mapping value is deemed excellent (Only used in NBFM).
SINAD_MAPPING_VERY_GOOD	Threshold at which the SINAD mapping value is deemed very good (Only used in NBFM).
SINAD_MAPPING_GOOD	Threshold at which the SINAD mapping value is deemed good (Only used in NBFM).
SINAD_MAPPING_FAIR	Threshold at which the SINAD mapping value is deemed fair (Only used in NBFM).
SINAD_MAPPING_POOR	Threshold at which the SINAD mapping value is deemed poor (Only used in NBFM).
CARRPWR_MAPPING_EXCELLENT	Threshold at which the Carrier Power mapping value is deemed excellent (Only used in NBFM).
CARRPWR_MAPPING_VERY_GOOD	Threshold at which the Carrier Power mapping value is deemed very good (Only used in NBFM).
CARRPWR_MAPPING_GOOD	Threshold at which the Carrier Power mapping value is deemed good (Only used in NBFM).
CARRPWR_MAPPING_FAIR	Threshold at which the Carrier Power mapping value is deemed fair (Only used in NBFM).
CARRPWR_MAPPING_POOR	Threshold at which the Carrier Power mapping value is deemed poor (Only used in NBFM).
THD_MAPPING_EXCELLENT	Threshold at which the THD mapping value is deemed excellent (Only used in NBFM).

Table 17-1. Returned Parameter Values in Trace Preamble (Sheet 7 of 7)

Parameter Name	Description
THD_MAPPING_VERY_GOOD	Threshold at which the THD mapping value is deemed very good (Only used in NBFM).
THD_MAPPING_GOOD	Threshold at which the THD mapping value is deemed good (Only used in NBFM).
THD_MAPPING_FAIR	Threshold at which the THD mapping value is deemed fair (Only used in NBFM).
THD_MAPPING_POOR	Threshold at which the THD mapping value is deemed poor (Only used in NBFM).
AUTO_SCAN	State of auto scan. Determines if instrument will automatically scan for a signal and set the receiver frequency to the signal with the highest signal strength (Only used in NBFM). 1 is OFF and 0 is ON.
OCC_BW_METHOD	Occupied bandwidth method (Only used in NBFM). 0 is % Int Power and 1 is > dBc.
OCC_BW_PERCENT	% Int Power (Only used in NBFM).
OCC_BW_DBC	> dBc (Only used in NBFM).
TONE_TYPE	Tone type selection (Only used in NBFM). Determines display of the last summary slot. 0 is CTCSS, 1 is DCS, and 2 is DTMF.
CTCSS_FREQ	Frequency of CTCSS generator pattern (Only used in NBFM).
DCS_TYPE	Type of DCS generator pattern (Only used in NBFM).
DTMF_TONE	Tone of DTMF generator pattern (Only used in NBFM).
FREQ_DISPLAY_TYPE	Determines whether carrier frequency or frequency error is shown in the summary window (Only used in NBFM). 0 is Carrier Frequency, 1 is Frequency Error.
TONE_DEVIATION	Tone deviation for the nbmf_ctcss, nbfm_dcs, nbfm_1khz_ctcss, and nbfm_1khz_dcs generator patterns (Only used in NBFM).
IF_BANDWIDTH	IF Bandwidth setting (Only used in NBFM). 0 is 5 kHz, 1 is 6.25 kHz, 2 is 10 kHz, 3 is 12.5 kHz, 4 is 30 kHz, 5 is 50 kHz.
IF_BANDWIDTH_PERCENT	Percent of IF Bandwidth used to calculate Y-Axis for Audio Spectrum and Audio Waveform graphs in NBFM Analyzer (Only used in NBFM).
WACN_ID	Not used.
SYSTEM_ID	Not used.
COLOR_CODE	Not used.

:TRACe[:DATA]? ALL|CONStellation|SPECtrum|EYEDiagram

Description: Transfers trace data from the instrument to the controller. Before executing this command the instrument must be set to the desired measurements. The command will only retrieve the data for graph types currently displaying on the screen. The ASCII 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 format of the block data in the query form is specified by :FORMat:DATA. Trace setup information can be acquired using :TRACe[:DATA]:PREamble? Use the commands in the MMEMory subsystem to recall traces from the instrument memory.

Each graph type will have ASCII start tags and end tags. All tags will be included no matter what the input parameter is. Graph data that has not been requested will have a start tag followed by an end tag with no data in between. The following is a list of all possible start and end tags:

Start Tag	End Tag
<CONSTELLATION>	</CONSTELLATION>
<SPECTRUM>	</SPECTRUM>
<EYE_DIAGRAM>	</EYE_DIAGRAM>

The tags listed above will always show up in the response and will always be in the order described.

Constellation data will have two elements per point. There will be 551 constellation points total.

Spectrum data will only have one element per point. There will also only be 551 points per trace.

Eye diagram will have 12 X-axis points followed by (12 x ((551 / Number Of Symbols) - 1)) Y-axis points.

Each eye line will consist of 12 Y-axis points combined with the X-axis points that are sent at the beginning.

Please note that this command only works in the TETRA Analyzer measurement.

Cmd Parameters: **NA**

Query Parameters: ALL|CONStellation|SPECtrum|EYEDiagram

Range: ALL|CONStellation|SPECtrum|EYEDiagram

Default Value: **NA**

Default Unit: **NA**

Example: To transfer spectrum data:

```
:TRACe? SPECtrum
```

Front Panel Access: **NA**

17-12 :UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

:UNIT:POWer:RX DBM|WATT|VOLTs
:UNIT:POWer:RX?

Description: Sets the receiver unit to dBm or Watts or Volts. If the unit is set to dBm, the TETRA Analyzer received power (from `FETCh:SIGAnalyzer?` or `READ:SIGAnalyzer?` or `MEASURE:SIGAnalyzer?`) and the squelch setting will be set and queried in dBm. If the unit is set to Watts, the TETRA Signal Analyzer received power and squelch setting will be set and queried in fW. If the unit is set to Volts, the TETRA Signal Analyzer received power and squelch setting will be set and queried in fV.

Cmd Parameters: DBM|WATT|VOLTs

Query Parameters: **NA**

Range: DBM|WATT|VOLTs

Default Value: DBM

Default Unit: **NA**

Example: To set the receiver units to watts:

`:UNIT:POWer:RX WATT`

Front Panel Access: **Amplitude**, Units, Rx Units

17-13 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

`[:SENSe]:APPLication:TST?`

Description: Triggers an application self-test. This command returns a 1 if all the tests passed and a 0 if one or more of the tests failed. Use `[:SENSe]:APPLication:TST:RESult?` to retrieve the detailed results of the test.

Note	The application self-test can take longer than five seconds to complete, depending on the current application. Add a delay of at least 10 seconds to allow the application self-test to complete to avoid any time-out errors.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To trigger a self-test:

`:SENSe:APPLication:TST?`

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:APPLication:TST:RESult?

Description: Retrieves the detailed results from the application self-test. `[:SENSe]:APPLication:TST?` must be called before this command to get correct results.

The response begins with an ASCII header. The header specifies the number of following bytes. It appears in the format `#AX`, where `A` is the number of digits in `X`, and `X` is the number of bytes that follow the header. There will be a total of 18 fields in the return string and will have the following format:

PASSED/FAILED, PASSED/FAILED, Int, Int, Int, Int¸ Int, Int, Int, Int, Int, Int, Int, PASSED/FAILED, Float, Float, Float, String.

The first PASSED/FAILED field represents the overall test result. The second field represents whether the signal generator is functioning properly. Fields 3 through 13 show the PLL status at the following frequencies:

500000 Hz, 160500000 Hz, 320500000 Hz, 480500000 Hz, 640500000 Hz, 800500000 Hz, 960500000 Hz, 1120500000 Hz, 1280500000 Hz, 1440500000 Hz, 1600000000 Hz

Field 18 shows the Level Cal version.

There are four PLLs that are tested on the signal generator and an integer from 0 to 15 is shown in each field. Each PLL represents one of the four bits in the integer number. Below is a description of the PLLs and the bits that they correspond to:

Bit 0: Sys PLL
Bit 1: IQ PLL
Bit 2: LO PLL
Bit 3: VR PLL

A 1 in the bit means that the PLL is functioning properly and a 0 means there is something wrong with the PLL. For example, a value of 13 (1101) means that the IQ PLL has failed. Field fourteen describes whether the internal SINAD hardware test has passed or failed. The 3 floats following the PASSED/FAILED field are the SINAD level, SINAD frequency, and the SINAD peak to peak value.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To display the detailed test results:

```
:APPLication:TST?;:APPLication:TST:RESult?
```

Front Panel Access: **Shift 8 (System)**, Application Self Test

[:SENSe]:AVERage:COUNt <integer>
[:SENSe]:AVERage:COUNt?

Description: Sets the number of times the numerical values in the TETRA Analyzer Summary window are averaged.

Cmd Parameters: <integer>

Query Parameters: **NA**

Range: 1 to 25

Default Value: 1

Default Unit: **NA**

Example: To set averaging to 15:

`:AVERage:COUNt 15`

Front Panel Access: **Setup**, More, Averaging

[:SENSe]:CORRection:OFFSet[:MAGNitude] <value>
[:SENSe]:CORRection:OFFSet[:MAGNitude]?

Description: Sets the receiver power offset. Please note that when Auto Rx Range is set to On, changing the offset value will cause the Ref Level to change. For example, if the reference level is at 7.0 dBm and the Rx power offset is then set to 10 dB external gain, the value of the refererence level will be automatically adjusted down to -3.0 dBm.

If Auto Rx Range is Off, any adjustments to the offset will be reflected in the vertical position of the spectrum trace. The reference level will not be adjusted.

The Received Pwr value in the Summary Table is also affected by changing this value.

The query returns a value from -100 to 100. A negative sign means external gain and no sign means external loss.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 100 dB Ext Loss to 100 dB Ext Gain

Default Value: 0 dB

Default Unit: dB

Example: To set the external attenuation to 30 dB:

`:CORRection:OFFSet 30`

Front Panel Access: **Amplitude**, Rx Power Offset

[:SENSe]:DM:FORMat BS|MS
[:SENSe]:DM:FORMat?

Description: Sets the modulation type to Base Station (BS) or Mobile Station (MS). Please note that setting the modulation type will restart the sweep.

Cmd Parameters: `BS|MS`

Query Parameters: **NA**

Range: BS|MS

Default Value: BS

Default Unit: **NA**

Example: To set the modulation type to MS:

```
:DM:FORMat MS
```

Front Panel Access: **Setup**, Mod Type

[:SENSe]:DM:SQUelch <value>
[:SENSe]:DM:SQUelch?

Description: Sets the squelch power level. The squelch is only applied to the TETRA Analyzer Summary window on the front panel and will blank out (--) all summary measurements except for Received Pwr when the received power level is lower than the squelch power setting. `FETCh:SIGAnalyzer?`, `READ:SIGAnalyzer?`, and `MEASure:SIGAnalyzer?` will always return all numerical values.

The query will be returned in the units (dBm, Watts, or Volts) selected through the Rx Units button using the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting is returned in dBm. If the unit is set to Watts, the squelch setting is returned in fW. If the unit is set to Volts, the squelch setting is returned in fV.

The set command is sent using the units selected with the Rx Units button on the front panel or with the command: `UNIT:POWer:RX`. If the Rx Units has been set to dBm, the squelch setting must be set in dBm. If the unit is set to watts, the squelch setting must be set in fW. If the unit is set to Volts, the squelch setting must be set in fV.

Cmd Parameters: <value>

Query Parameters: NA

Range: 0 dBm to -120 dBm or 1 fW to 1000000000000 fW
or 223.6 mV to 223.61 nV

Default Value: -100 dBm

Default Unit: dBm

Example: To set the squelch to -10 dBm:

```
:DM:SQUelch -10
```

Front Panel Access: **Setup**, Squelch Lvl

[:SENSe]:FREQuency:CENTer <value>
[:SENSe]:FREQuency:CENTer?

Description: Sets the receiver center frequency. Please note that setting the center frequency will restart the sweep

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: For 1.6 GHz Model: 100000 Hz to 1600000000 Hz
For 6 GHz Model: 100000 Hz to 6000000000 Hz

Default Value: 800000000 Hz

Default Unit: Hz

Example: To set the center frequency to 145 MHz:

`:FREQuency:CENTer 145000000`

Front Panel Access: **Frequency**, Rx Freq

[:SENSe]:FREQuency:SPAN 25|50|100|500|1000|5000
[:SENSe]:FREQuency:SPAN?

Description: Sets the span of the Spectrum display in TETRA Analyzer measurement mode.

Note: Span value is set and returned in kHz.

Cmd Parameters: `25|50|100|500|1000|5000`

Query Parameters: NA

Range: 25|50|100|500|1000|5000

Default Value: 25

Default Unit: kHz

Example: To set the span to 1 MHz:

`:SENSe:FREQuency:SPAN 1000`

Front Panel Access: **Frequency**, Span

[:SENSe]:POWer[:RF]:RANGe[:IMMediate]

Description: Turns off auto ranging and adjusts the receiver reference level once. In TETRA Analyzer measurement, this command adjusts the receiver reference level of the spectrum graph.

Cmd Parameters: **NA**

Query Parameters: **NA**

Range: **NA**

Default Value: **NA**

Default Unit: **NA**

Example: To adjust range:

`:POWer:RANGe`

Front Panel Access: **Amplitude**, Adjust Rx Range

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1
[:SENSe]:POWer[:RF]:RANGe:AUTO?

Description: Turns auto range for the receiver on or off. When auto range is on, the reference level is automatically adjusted to the proper value to show the trace on the screen. If the auto ranging is turned off, the reference level will not adjust according to where the trace is. In TETRA Analyzer measurement, this command adjusts the reference level of the spectrum graph.

Cmd Parameters: `OFF|ON|0|1`

Query Parameters: **NA**

Range: OFF|ON|0|1

Default Value: ON or 1

Default Unit: **NA**

Example: To turn auto ranging off:

`:POWer:RANGe:AUTO OFF`

Front Panel Access: **Amplitude**, Auto Rx Range

[:SENSe]:SYMBolspan <value>
[:SENSe]:SYMBolspan?

Description: Sets the symbol span. Please note that this setting only affects the Eye Diagram in the TETRA Analyzer measurement. Please note that setting the symbol span will restart the sweep.

Cmd Parameters: `<value>`

Query Parameters: **NA**

Range: 2 to 5

Default Value: 2

Default Unit: **NA**

Example: To set the symbol span to 4:

```
:SYMBolspan 4
```

Front Panel Access: **Measurement**, TETRA Analyzer, Symbol Span

Chapter 18 — AM/FM/PM Commands

18-1 :CALCulate Subsystem

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

:CALCulate:MARKer{1|2|3|4|5|6}[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}[:STATe]?

Title: Marker State

Description: Sets the specified marker on/off.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn off reference marker #1:

```
:CALCulate:MARKer1:STATe OFF
```

Front Panel Access: Marker, On/Off

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}:DELTa[:STATe]?

Title: Delta Marker State

Description: Sets the specified delta marker on or off.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on delta marker #3:

```
:CAL1Culate:MARKer3:DELTa ON
:CALCulate:MARKer3:DELTa 1
:CALCulate:MARKer3:DELTa:STATe ON
:CALCulate:MARKer3:DELTa:STATe 1
```

To turn off delta marker #6

```
:CALCulate:MARKer6:DELTa OFF
:CALCulate:MARKer6:DELTa:STATe OFF
:CALCulate:MARKer6:DELTa:STATe 0
```

Front Panel Access: Marker, Delta

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:X <x-parameter>
:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:X?

Title: Delta Marker X Value

Description: Sets the location of the delta marker on the x-axis at the specified location
<x-parameter> plus the reference marker x-axis. <x-parameter> is defined in the current x-axis units. The query version of the command returns the location of the delta marker on the x-axis.

Parameter: <x-parameter>

Default Unit: Hz or seconds if in Audio Waveform.

Example: If both the reference and delta marker #1 is currently at 1 GHz on the x-axis, send thecommand below to set the delta marker #1 to 2 GHz on the x-axis:

`:CALCulate:MARKer1:DELTa:X 1GHz`

(In Audio Waveform) If both the reference and delta marker #1 is currently at 25 µs on the x-axis, send the command below to set the delta marker to 50µs on the x-axis:

`:CALCulate:MARKer1:DELTa:X 25µs`

Related Command: `:CALCulate:MARKer[1]|2|3|4|5|6:X`

Front Panel Access: Marker, Delta

:CALCulate:MARKer{1|2|3|4|5|6}:DELTa:Y?

Title: Delta Marker Read Y Value

Description: In RF spectrum view, the value is returned in dBm. In Audio Spectrum or Audio Waveform view, the value is returned in % for AM, Hz for FM and Radians for PM.

Default Unit: Current y-axis unit

:CALCulate:MARKer{1|2|3|4|5|6}[:SET]:CENTer

Title: Marker Frequency to Center

Description: In RF spectrum view, this command sets the center frequency equal to the frequency of the specified marker. Note that this will result in a change to the start and stop frequencies and may also result in a change to the span. Note that this command is not valid in Audio Spectrum, Audio Waveform and Summary view.

Front Panel Access: Marker, Marker Freq to Center

:CALCulate:MARKer{1|2|3|4|5|6}:MAXimum

Title: Marker (Maximum) Peak Search

Description: Puts the specified marker at the maximum amplitude in the trace.

Front Panel Access: Marker, Marker [1/2/3/4/5/6], Peak Search
Marker, Marker [1/2/3/4/5/6], More Peak Options, Peak Search

:CALCulate:MARKer{1|2|3|4|5|6}[:SET]:RLEVel

Title: Marker to Reference Level

Description: Sets the reference level equal to the measured amplitude of the specified marker. Note that this may result in a change to the input attenuation. Note that this command is not valid in Audio Spectrum, Audio Waveform and Summary view.

Front Panel Access: Marker, Marker to Ref Lvl

:CALCulate:MARKer{1|2|3|4|5|6}:X <x-parameter>
:CALCulate:MARKer{1|2|3|4|5|6}:X?

Title: Marker X Value

Description: Sets the location of the marker on the x-axis at the specified location. <x-parameter> is defined in the current x-axis units. The query version of the command returns the location of the marker on the x-axis. Note that the marker is snapped to the data point closest to the specified value. If the specified marker is not on it is set to on.

Parameter: <x-parameter>

Default Unit: Hz or seconds if in Audio Waveform.

Example: To set reference marker #2 to 5 hertz on the x-axis:

```
:CALCulate:MARKer2:X 5
:CALCulate:MARKer2:X 5Hz
```

To set reference marker #1 to 1.5 GHz on the x-axis:

```
:CALCulate:MARKer:X 1.5GHz
:CALCulate:MARKer1:X 1.5GHz
```

(In Audio Waveform) To set reference marker #3 to 1.5 milli-seconds on the x-axis:

```
:CALCulate:MARKer3:X .0015
:CALCulate:MARKer3:X 1.5ms
```

:CALCulate:MARKer{1|2|3|4|5|6}:Y?

Title: Marker Read Y Value

Description: In RF spectrum view, the value is returned in dBm. In Audio Spectrum or Audio Waveform view, the value is returned in % for AM, Hz for FM and Radians for PM.

Default Unit: Current y-axis unit

:CALCulate:MARKer:AOFF

Title: Turn All Markers Off

Description: Turns off all markers.

Front Panel Access: Marker, More, All Markers Off

:CALCulate:MARKer:TABLe[:STATe] OFF|ON|0|1
:CALCulate:MARKer:TABLe[:STATe]?

Title: Marker Table State

Description: Turns the Marker Table on or off. Setting the value to ON or 1 will turn on the marker table. Setting the value to OFF or 0 will turn off the marker table.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on marker table:

```
:CALCulate:MARKer:TABLe ON
:CALCulate:MARKer:TABLe 1
```

18-2 :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:WINDow:TRACe:Y[:SCALe]:PDIVision <rel ampl>
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Title:	Scale
Description:	Sets the scale (dB/division) for the y-axis in RF Spectrum view.
Parameter:	<rel ampl>
Default Value:	10 dB/div
Default Unit:	dB
Range:	1 dB to 15 dB
Front Panel Access:	Amplitude, Scale

:DISPlay:WINDow:TRACe:Y:AFPanalyzer:PWR:OFFSet <rel ampl>
:DISPlay:WINDow:TRACe:Y:AFPanalyzer:PWR:OFFSet?

Title:	Power Offset
Description:	Sets the power offset value for the y-axis in RF Spectrum view.
Parameter:	<rel ampl>
Default Value:	0 dB
Default Unit:	dB
Range:	-100 dB to 100 dB
Front Panel Access:	Amplitude, Power Offset

18-3 :FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred. The format setting affects data in specific commands only. If a command is affected, it is noted in the command description.

:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,[<length>]
:FORMat[:READings][:DATA]?

Title: Numeric Data Format

Description: This command specifies the format in which data is returned in certain commands. The optional <length> 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 no length is specified, the default length of REAL data is set to 64 bits.

ASCii format returns the data in comma-separated ASCII format. The units are
dBm for RF Spectrum, % for AM Audio Spectrum/Waveform, Hz for FM Audio Spectrum/Waveform, Radians for PM Audio Spectrum/Waveform.

This format requires many more bytes so it is the slowest format. INTeger,
32 values are signed 32-bit integers in little-endian byte order. This format
returns the data in 4-byte blocks. The units are mdBm for RF Spectrum, 1000*% for AM Audio Spectrum/Waveform, Hz for FM Audio Spectrum/Waveform, milli-Radians for PM Audio Spectrum/Waveform.

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 dBm for RF Spectrum, % for AM Audio Spectrum/Waveform,
Hz for FM Audio Spectrum/Waveform, Radians for PM Audio Spectrum/Waveform.

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 dBm for RF Spectrum, % for AM Audio Spectrum/Waveform, Hz for FM Audio Spectrum/Waveform, Radians for PM Audio Spectrum/Waveform.

Both INTeger and REAL formats return a definite block length. Each transfer begins with an ASCII header such as #42204 for INTeger,32 and REAL,32 and #44408 for REAL,64. The first digit represents the number of following digits in the header (in this example, 4). The remainder of the header indicates the number of bytes that follow the header (in this example, 2204 for INT,32 and REAL,32 and 4408 for REAL,64). Divide the number of following bytes by the number of bytes in the data format chosen
(4 for both INTeger,32 and REAL,32, and 8 for REAL,64) to get the number of data points (in this example, 551).

Parameter: ASCii | INTeger,32 | REAL,[<length>]

Parameter Type: <char>

Default Value: ASCii

Related Command: `:TRACe[:DATA]`

18-4 :INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate[:IMMediate]

Title: Trigger Sweep/Measurement

Description: Initiates a sweep/measurement. If :INITiate:CONTinuous is set to ON, this command is ignored. Use this command in combination with :STATus:OPERation? 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. An :INITiate[:IMMediate] command must be issued for each additional sweep desired.

Related Command: `:INITiate:CONTinuous`
`:STATus:OPERation?`

Front Panel Access: Shift-3 (Sweep), Manual Trigger

:INITiate:CONTinuous OFF|ON|0|1
:INITiate:CONTinuous?

Title: Continuous/Single Sweep

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 enters the “idle” state and waits for the :INITiate[:IMMediate] command or for :INITiate:CONTinuous ON. 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. Note that rapid toggling between ON and OFF is not allowed. The instrument must be allowed to make a full sweep before toggling can be done.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: ON

Related Command: `:INITiate[:IMMediate]`

Front Panel Access: Shift-3 (Sweep), Sweep

18-5 :MMEMory Subsystem

The Mass Memory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:DELete <file name>

Title: Delete Setup/Measurement

Description: Removes the measurement or setup file specified by <file name> from the current mass storage device. <file name> should be enclosed in either single quotes (' ') or double quotes (" "). It should contain one of the following file extensions:

".stp" for setup
".spa" for SPA measurement
".wmxd" for WiMAX
".wmxe" for Mobile WiMAX measurements
".vna" for Cable & Antenna measurements
".ia" for Interference Analysis measurements
".cs" for Channel Scanner measurements
".p25" for P25 Analyzer measurements
".p252" for P25p2 Analyzer measurements
".nxdn" for NXDN Analyzer measurements
".dpmr" for dPMR Analyzer measurements
".dmr" for DMR 2 Analyzer measurements
".ptc" for PTC Analyzer measurements
".afp" for AMFMPM Analyzer measurements

Use the command MMEMory:MSIS to set the current save location.

Parameter: <file name>

Related Command: `:MMEMory:STORE:STATe`
`:MMEMory:STORe:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: Shift-7 (File), Delete, Delete Selected File

:MMEMory:LOAD:STATe <integer>,<file name>

Title: Recall Setup

Description: Recalls a previously stored instrument setup in the current save location. The setup file to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

Parameter: <integer>, <file name>

Related Command: `:MMEMory:STORe:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: Shift-7 (File), Recall

:MMEMory:LOAD:TRACe <integer>,<file name>

Title: Recall Measurement

Description: The instrument must be in the mode of the saved trace in order to recall that trace.Use :INSTrument:SELect or :INSTrument:NSELect to set the mode. Recalls a previously stored measurement trace from the current save location. The saved measurement trace to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should contain a file extension. Note that the trace specified by <file name> should be available at the current save location.

Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

File name extensions:

“`.spa`” for SPA measurement
“`.mna`” for VNA and VVM measurements
“`.hipm`” for HiPM measurements
“`.pm`” for PM measurements
“`.cwsg`” for CWSG measurements
“`.afp`” for AM/FM/PM measurements
“`.ia`” for Interference Analysis measurements
“`.cs`” for Channel Scanner measurements
“`.wmxd`” for WiMAX
“`.wmxe`” for Mobile WiMAX
“`.lte`” for LTE measurements
“`.p25`” for P25 measurements
“`.p252`” for P25p2 measurements
“`.nxdn`” for NXDN measurements
“`.dpmr`” for dPMR measurements
“`.dmr2`” for DMR 2 measurements
“`.ptc`” for PTC measurements
“`.tetra`” for TETRA measurements
“`.nbfm`” for NBFM measurements

Note: Extensions not available for T1 and Hi_PM.

Parameter: <integer>, <file name>

Example: To recall trace with file name “trace”:

`:MMEMory:LOAD:TRACe 1,”trace.afp”`

Related Command: `:MMEMory:STORe:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: Shift-7 (File), Recall Measurement

:MMEMory:STORe:STATe <integer>,<file name>

Title: Save Setup

Description: Stores the current setup into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a value of 0.

Parameter: <integer>, <file name>

Related Command: `:MMEMory:LOAD:STATe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: Shift-7 (File)

:MMEMory:STORe:TRACe <integer>,<file name>

Title: Save Measurement

Description: Stores the trace into the file specified by <file name>. <file name> should be enclosed in either single quotes (‘ ’) or double quotes (“ ”) and should not contain a file extension. Use the command MMEMory:MSIS to set the current save location. The <integer> parameter is not currently used, but it must be sent. Send a 0.

Parameter: <integer>, <file name>

Example: To save the trace into the file name “trace”:

`:MMEMory:STORe:TRACe 0,"trace"`

Related Command: `:MMEMory:LOAD:TRACe`
`:MMEMory:MSIS INTernal|USB`

Front Panel Access: Shift-7 (File), Save

18-6 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe[:DATA]?

Title: Trace Data Transfer

Description: This command transfers data from the controlling program to the instrument. The query form transfers trace data from the instrument to the controller. Data is transferred to the instrument enclosed in parentheses as (<header><block>) and from the instrument as <header><block>.

The ASCII 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 format of the block data in the query form is specified by :FORMat:DATA. The block data in the command form is always sent in ASCII format.

To acquire the data from the trace in the instrument, send :TRACe[:DATA]? A 551 point trace is returned as #42204<block data>. <block> data could be in either INTeger,32 or REAL,32 format. In both cases, there is 4 bytes per data point. So, 4 bytes per point * 551 data points gives 2204 bytes in <block> data. This example assumes that :FORMat:DATA INTeger,32 or :FORMat:DATA REAL,32 has been sent to the instrument before the query command is sent.

The query command will return a #0 if data is invalid for the active trace.

Related Command: `:FORMat:DATA`

18-7 [:SENSe] Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:AFPanalyzer:AVERage:COUNt <avg count>
[:SENSe]:AFPanalyzer:AVERage:COUNt?

Title: Measurement Average

Description: Sets the average count for the measurement data in the summary mode. The query format of this command returns the value only in the summary mode. The query format returns nothing in other measurement modes.

Parameter: <number>

Range: 1 to 65535

Front Panel Access: Shift-4 (Measure), Average (only in Summary mode)

[:SENSe]:AFPanalyzer:DEMod:DATA?

Title: Summary data

Description: This query returns the measurment values in the Summary view. The order of the values are as follows:

<Modulation rate> in Hz, <RMS Deviation> in % or Hz or Rad depending on the demod type, <Peak-Peak/2 Dev> in % or Hz or Rad depending on the demod type, <SINAD> in dB, <THD> in % and <Distortion> in %. All values are comma separated.

Front Panel Access: Shift-4 (Measure), Audio Spectrum/Waveform

[:SENSe]:AFPanalyzer:DEMod:MODE RFSP|AFSP|AFWV|SUMMary
[:SENSe]:AFPanalyzer:DEMod:MODE?

Title: Demodulation Mode

Description: This command sets the demodulation mode (graph type) to RF spectrum(RFSP) or Audio Spectrum(AFSP) or Audio Waveform (AFWV) or Summary.

Parameter: RFSP|AFSP|AFWV|SUMMary

Default Value: RFSP

Example: To set the demodulation mode to Audio Waveform:

```
SENSe:AFPanalyzer:DEMod:MODE AFWV
```

Front Panel Access: Shift-4 (Measure)

[:SENSe]:AFPanalyzer:DEMod:TYPE AM|FM|PM
[:SENSe]:AFPanalyzer:DEMod:TYPE?

Title: Demodulation Type

Description: This command sets the demodulation type.

Parameter: AM|FM|PM

Default Value: AM

Example: To set the demodulation type to FM:

`SENSe:AFPanalyzer:DEMod:TYPE FM`

Front Panel Access: Setup, Demod Type

[:SENSe]:AFPanalyzer:FM:SCALe <percentage>
[:SENSe]:AFPanalyzer:FM:SCALe?

Title: FM Y-axis reference level percentage

Description: This command sets the Y-axis reference level as the percentage of the IF bandwidth in the FM Audio spectrum/waveform display.

Parameter: <percentage>

Default Value: 50

Default Unit: %

Range: 0% to 100%

Front Panel Access: Shift-4 (Measure), Audio Spectrum/Waveform, Scale: % IFBW

[:SENSe]:AFPanalyzer:IFBW <freq>
[:SENSe]:AFPanalyzer:IFBW?

Title: IF bandwidth

Description: Sets the IF bandwidth. Note that using this command turns the automatic IF bandwidth setting OFF.

Parameter: <freq>

Default Value: 300 kHz

Default Unit: Hz

Range: 1 kHz to 300 kHz in a 1:3 sequence

Related Command: `:AFPanalyzer:IFBW:AUTO`

Front Panel Access: Setup, IFBW

[:SENSe]:AFPanalyzer:IFBW:AUTO 0|1
[:SENSe]:AFPanalyzer:IFBW:AUTO?

Title: IF bandwidth coupling

Description: Sets the state of the coupling of the IF bandwidth to the span. Setting the value to 1 will result in the IF bandwidth being coupled to the span. That is, when the span changes, the IF bandwidth changes. Setting the value to 0 will result in the IF bandwidth being un-coupled from the span. That is, changing the span will not change the IF bandwidth.

Parameter: 0|1

Parameter Type: <boolean>

Default Value: 1

Front Panel Access: Setup, Auto IFBW

[:SENSe]:AFPanalyzer:PM:SCALe <Radians>
[:SENSe]:AFPanalyzer:PM:SCALe?

Title: PM Y-axis reference level

Description: This command sets the Y-axis reference level in the PM Audio spectrum/waveform display.

Parameter: <number>

Default Value: 3.140

Range: 3.140 to 3140

Front Panel Access: Shift-4 (Measure), Audio Spectrum/Waveform, Scale: milli-Rad

[:SENSe]:AFPanalyzer:RFSPectrum:DATA?

Title: Summary data

Description: This query returns the measurment values in the RF spectrum view. The order of the values are as follows:

<carrier power> in dBm, <carrier freq> in Hz, <Occ BW> in Hz. All values are comma separated.

Front Panel Access: Shift-4 (Measure), RF Spectrum.

[:SENSe]:AFPanalyzer:SPAN <freq>
[:SENSe]:AFPanalyzer:SPAN?

Title: Audio Frequency Span

Description: Sets the audio frequency span in the audio spectrum view. Valid values are 2 kHz, 5 kHz, 10 kHz, 20 kHz and 70 kHz.

Parameter: <freq>

Default Unit: Hz

Front Panel Access: Shift-4 (Measure), Audio Spectrum, Span

[:SENSe]:AFPanalyzer:SWEep:TIME <time>
[:SENSe]:AFPanalyzer:SWEep:TIME?

Title: Audio Waveform sweep time

Description: Sets the audio waveform sweep time in the audio waveform view.

Parameter: <time>

Default Unit: Secs

Range: 50 μs to 50 ms.

Front Panel Access: Shift-4 (Measure), Audio Waveform, Sweep Time

[:SENSe]:AFPanalyzer:SUMMary:DATA?

Title: Summary data

Description: This query returns the measurment values in the Summary view. The order of the values are as follows:

<demod type> (AM|FM|PM), <RMS Deviation> in % or Hz or Rad depending on the demod type, <Peak+ Deviation> in % or Hz or Rad depending on the demod type, <Peak-Dev> in % or Hz or Rad depending on the demod type,
<Peak-Peak/2 Dev> in % or Hz or Rad depending on the demod type, <carrier power> in dBm, <carrier freq> in Hz, <Occ BW> in Hz, <Modulation rate> in Hz, <SINAD> in dB, <THD> in % and <Distortion> in %. All values are comma separated.

Front Panel Access: Shift-4 (Measure), Summary.

[:SENSe]:FREQuency:CENTer <freq>
[:SENSe]:FREQuency:CENTer?

Title: Center Frequency

Description: Sets the center frequency. Note that changing the value of the center frequency may also change the value of the span.

Parameter: <freq>

Default Unit: Hz

Front Panel Access: Freq, Center Freq

[:SENSe]:FREQuency:SIGStandard:CHANnel <number>
[:SENSe]:FREQuency:SIGStandard:CHANnel?

Title: Channel Selection

Description: Sets the channel number for the selected signal standard.

Parameter: <number>

Front Panel Access: Freq, Channel

[:SENSe]:FREQuency:SIGStandard:NAMe <string>
[:SENSe]:FREQuency:SIGStandard:NAMe?

Title: Signal Standard

Description: Selects the desired signal standard from the list. The <string> argument is the name of the desired signal standard as displayed in the instrument's current signal standard list. The list can be displayed on the instrument by choosing the Signal Standard submenu button in the Freq menu. The list can also be downloaded remotely and viewed using Anritsu Master Software Tools. For example, if the desired Signal Standard is:

P-GSM 900 - Uplink then the value of the <string> would be "P-GSM 900 - Uplink".

The query form of this command will return the name of the currently selected Signal Standard on the list.

Parameter: <string>

Front Panel Access: Freq, Signal Standard

[:SENSe]:FREQuency:SPAN <freq>
[:SENSe]:FREQuency:SPAN?

Title: Frequency Span

Description: Sets the frequency span. Minimum value and the maximum value are 10 kHz and 10 MHz respectively. Note that changing the value of the frequency span may change the Center Frequency.

Parameter: <freq>

Default Unit: Hz

Front Panel Access: Freq, Span

[:SENSe]:FREQuency:SPAN:FULL

Title: Frequency Span – Full

Description: Sets the frequency span to maximum span (10 MHz). Note that changing the value of the frequency span may change the Center Frequency.

Front Panel Access: Freq, Span, Max Span

[:SENSe]:FREQuency:SPAN:MINimum

Title: Frequency Span – Minimum

Description: Sets the frequency span to minimum span (10 kHz). Note that changing the value of the frequency span may change the Center Frequency.

Front Panel Access: Freq, Span, Min Span

[:SENSe]:FREQuency:SPAN:PREVious

Title: Frequency Span – Last

Description: Sets the frequency span to the previous span value. Note that changing the value of the frequency span may change the Center Frequency.

Default Unit: Hz

Front Panel Access: Freq, Span, Last Span

[:SENSe]:FREQuency:STEP[:INCRement] <freq>
[:SENSe]:FREQuency:STEP[:INCRement]?

Title: Frequency Step

Description: Sets the frequency step to the given frequency value.

Parameter: <freq>

Default Value: 1 MHz

Default Unit: Hz

Range: 1 Hz to 20 GHz

Front Panel Access: Freq, Freq Step

[:SENSe]:OBWidth:METHod XDB|PERCent
[:SENSe]:OBWidth:METHod?

Title: Occupied Bandwidth Measurement 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.

Parameter: XDB|PERCent

Parameter Type: <char>

Default Value: PERCent

Related Command: `:OBWidth:XDB :OBWidth:PERCent`

Front Panel Access: Shift-4 (Measure), RF Spectrum, Occ BW Method

[:SENSe]:OBWidth:PERCent <percentage>
[:SENSe]:OBWidth:PERCent?

Title:	Occupied Bandwidth Percent of Power
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.
Parameter:	<percentage>
Default Value:	99
Default Unit:	%
Range:	0% to 100%
Related Command:	`:OBWidth:METHod`
Front Panel Access:	Shift-4 (Measure), RF Spectrum, %

[:SENSe]:OBWidth:XDB <rel ampl>
[:SENSe]:OBWidth:XDB?

Title:	Occupied Bandwidth dB Down
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.
Parameter:	<rel ampl>
Default Value:	3 dBc
Default Unit:	dBc
Range:	0 to 100 dBc
Related Command:	`:OBWidth:METHod`
Front Panel Access:	Shift-4 (Measure), RF Spectrum, dBc

Appendix A — Example

A-1 C/C++

This example is run on the command line. It sends the *IDN? query to the instrument and prints the response to the console.

```
// IdnExample.cpp : Microsoft Visual Studio-Generated Example
//     Based on Example 2-1 in the NI-VISA User Manual
//     Usage : IdnExample "TCPIP::xxx.xxx.xxx.xxx::inst0::INSTR"
//        where xxx.xxx.xxx.xxx is the IP address of the
//        instrument.
//     Output : The string identity string returned from the
//        instrument.
//     VISA Header : visa.h (must be included)
//     VISA Library : visa32.lib (must be linked with)

#include "stdafx.h"
#include "stdio.h"
#include "string.h"
#include "visa.h"

#define BUFFER_SIZE 255

int main(int argc, char* argv[])
{
     ViStatus status; /* For checking errors */
     ViSession defaultRM, instr; /* Communication channels */
     ViUInt32 retCount; /* Return count from string I/O */
     ViChar buffer[BUFFER_SIZE]; /* Buffer for string I/O */
     char tempDisplay[BUFFER_SIZE]; /* Display buffer for example */
     char *pAddress;

     /* Make sure we got our address. */
     if ( argc < 2 )
     {
       printf("Usage: IdnExample
       \"TCPIP::xxx.xxx.xxx.xxx::inst0::INSTR\"\n");
       printf("\t where xxx.xxx.xxx.xxx is the IP address of your
       instrument.\n");
       return -1;
     }

     /* Store the address. */
     pAddress = argv[1];

     /* Begin by initializing the system*/
     status = viOpenDefaultRM(&defaultRM);
```

```
    if (status < VI_SUCCESS)
    {
        /* Error Initializing VISA...exiting*/
        printf("Can't initialize VISA\n");
        return -1;
    }

    /* Open communication with TCP/IP device at xxx.xxx.xxx.xxx*/
    /* NOTE: For simplicity, we will not show error checking*/
    /* TODO: Add error handling. */
    status = viOpen(defaultRM, pAddress, VI_NULL, VI_NULL, &instr);

    /* Set the timeout for message-based communication*/
    /* TODO: Add error handling. */
    status = viSetAttribute(instr, VI_ATTR_TMO_VALUE, 120000);

    /* Ask the device for identification */
    sprintf(buffer, "*IDN?\n");
    status = viWrite(instr, (unsigned char *)&buffer[0], 6, &retCount);
    status = viRead(instr, (unsigned char *)buffer, BUFFER_SIZE,
    &retCount);

    /* TODO: Add code to process data. */
    strncpy(tempDisplay, buffer, retCount);
    tempDisplay[retCount] = 0;   /* Null-terminate display string. */
    printf("*IDN? Returned %d bytes: %s\n", retCount, tempDisplay);

    /* Close down the system */
    /* TODO: Add error handling. */
    status = viClose(instr);
    status = viClose(defaultRM);

    return 0;
}
```

A-2 Visual Basic

This function can be called in a Visual Basic program. It sends the *IDN? query to the instrument and returns the byte count and ASCII response string.

```
Rem This example is based on Example 2-1 from the NI-VISA User Manual.

Public Sub IdnMain(ByVal address As String, ByRef byteCount As String,
ByRef returnBytes As String)
     Const BUFFER_SIZE = 200
     Dim stat As ViStatus
     Dim dfltRM As ViSession
     Dim sesn As ViSession
     Dim retCount As Long
     Dim buffer As String * BUFFER_SIZE

     Rem ***Include visa32.dll as a reference in your project.***

     Rem Begin by initializing the system
     stat = viOpenDefaultRM(dfltRM)
     If (stat < VI_SUCCESS) Then
       Rem Error initializing VISA...exiting
       MsgBox “Can't initialize VISA”
       Exit Sub
     End If

     Rem Open communication with Device
     Rem NOTE: For simplicity, we will not show error checking
     Rem TODO: Add error handling.
     stat = viOpen(dfltRM, address, VI_NULL, VI_NULL, sesn)

     Rem Set the timeout for message-based communication
     Rem TODO: Add error handling.
     stat = viSetAttribute(sesn, VI_ATTR_TMO_VALUE, 120000)

     Rem Ask the device for identification
     Rem TODO: Add error handling.
     stat = viWrite(sesn, “*IDN?”, 5, retCount)
     stat = viRead(sesn, buffer, BUFFER_SIZE, retCount)

     Rem TODO: Add code to process the data.
     byteCount = retCount
     returnBytes = Left(buffer, retCount)

     Rem Close down the system
     Rem TODO: Add error handling.
     stat = viClose(sesn)
     stat = viClose(dfltRM)
End Sub
```

Appendix B — Commands by Mode

This appendix lists all of the SCPI commands by measurement mode then alphabetic order. Note that these commands are hypertext links to the command lines within the individual chapters.

Chapter 1—General Information

Chapter 2—Programming with SCPI

Chapter 3—All Mode Commands

Chapter 4—Spectrum Analyzer Commands

Chapter 5—VNA Commands

Chapter 6—Vector Voltmeter Commands

Chapter 7—Fixed WiMAX Commands

Chapter 8—Mobile WiMAX Commands

Chapter 9—LTE Commands

Chapter 10—P25 Phase 1 Commands

Chapter 11—P25 Phase 2 Commands

Chapter 12—NXDN Commands

Chapter 13—dPMR Commands

Chapter 14—DMR 2 Commands

Chapter 15—PTC Commands

Chapter 16—NBFM Commands

Chapter 17—TETRA Commands

Chapter 18—AM/FM/PM Commands

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Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA
http://www.anritsu.com